ESAOTE

THE IMAGE OF INNOVATION™

E-SCAN XQ

DEDICATED MRI

MR

Service Manual

Installation Guide

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Part 1 Introduction

Read this first

The installation and service of equipment described herein is to be performed by qualified personnel which is employed or authorized by ESAOTE or one of its affiliates. Assemblers and other personnel not employed by nor directly affiliated with nor authorized by ESAOTE or one of its affiliates technical services are directed to contact the local office of ESAOTE or its affiliates before attempting installation or service procedures.

The following chapters are the reference guide for MR installations.

The individual installation steps are described in detail in the respective chapters of this manual.

Information regarding site planning is contained in the Planning Guide.

NOTICE	Only authorized personnel must carry out any installation, assembly, maintenance, extensions, regulation, modifications or repairs.

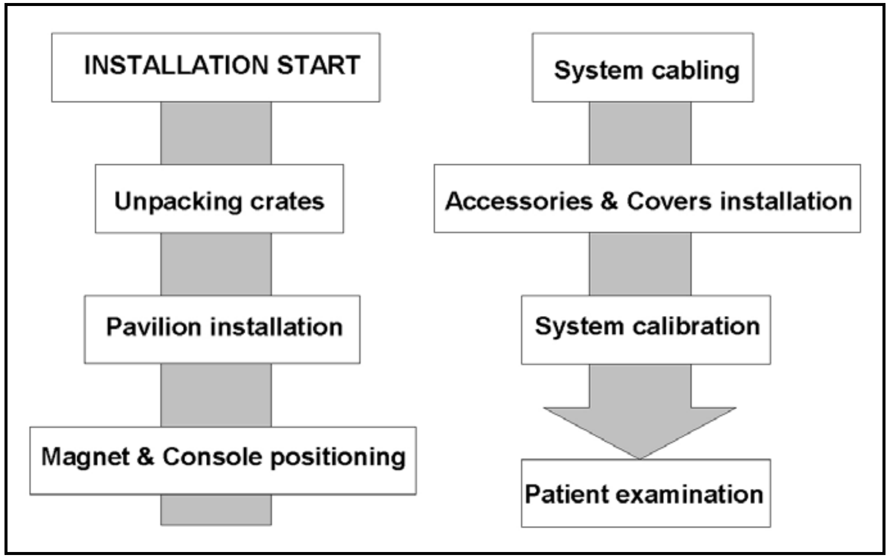
System Overview

Refer to the Site Planning Guide and Service manuals.

Installation flowchart

The flowchart below provides you with an overview of the complete installation.

Fig. 1: Installation flow chart



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Part 2 Safety

Introduction

The following general safety notes are supplemented by specific descriptions in the documents supplied by us, e.g. product documents, ARTD (general guidelines) as well as by written instructions in specific cases.

All safety instructions must be observed in the performance of work and tests; in addition, the prescribed country-specific requirements (e.g. occupational safety and accident prevention regulations) must be complied with.

General Safety Notes

⚠WARNING **Ferromagnetic objects may be attracted by the magnetic force field, and drawn in the direction of the gantry causing possible injuries to the patient being examined!!!**

Large moving ferro magnetic objects, such as a stretcher, for example, could disturb the uniformity of the magnetic field inside the magnet, causing artifacts to appear on the diagnostic image!!!

⚠WARNING **Make sure you use only non-ferro magnetic tools near the magnet. Do not put any other ferro magnetic object near the magnet (e.g. the metal support for transporting the magnet)!!!**

Be careful that screws, etc. or other metallic objects do not fall into the equipment, because they could cause a short circuit!!!

Changes made in products delivered by us

Changes made in products/systems delivered by us must not be implemented without our written release. This applies in particular to changes which may affect the mechanical and/or electrical safety or radiation-protection properties of a product (e.g. changing of safety distances, removal of locks/instructions, enlargement of the radiation-exit window on the lead cone, etc.).

Electrical installations

Electrical installations of medically used rooms in the Federal Republic of Germany must be made in accordance with the requirements of VDE Regulations 0107.

For all other countries, the regulations to be complied with (national and VDE regulations) must be taken from the installation sheets for the project concerned.

Notes and Symbols

The signal words and their classification anticipate their use in the planned TD Medical Solutions Standard that will be based on the Z535 ANSI Standard.

Emphasized texts in technical documentation have the following meaning:

⚠WARNING	**WARNING indicates a risk of danger that may lead to death or serious physical injury.**
CAUTION	**CAUTION used with the safety alert symbol indicates a risk of danger that leads to slight or moderate physical injury and/ or damage to property.**
NOTICE	NOTICE used without the safety alert symbol indicates a risk of danger that if disregarded leads or may lead to a potential situation which may result in an undesirable result or state other than death, physical injury or property damage.

Installation of electromedical equipment

All work must be carried out in accordance with the technical documentation. Make sure that all **protective ground wires** provided by the manufacturer are connected properly before starting the equipment after installation. This applies, for example, to all metallic covers that may develop a dangerous contact voltage in case of a fault. They must always be connected to the protective ground wire. To ensure this, the connection between these covers and the protective ground wire must be made with screws and con-tact washer or via the protective ground wires provided.

⏚ means **“Terminal for connection of equipment protective ground wire”.**

The protective ground wires must be connected between the system components and the power supply as shown in the wiring diagram. In the interest of the safety of our personnel and others, the protective ground wires must be installed prior to first switching on the product/system, as well as after completing all work, before turnover to the customer, in accordance with the product documentation.

Personal protection measures

The legally relevant and internal regulations and specifications concerning occupational safety and accident prevention (UVV and TI) must be observed, primarily in the interest of the persons performing the work. The notes below are given as additional information.

Unpacking

- When unpacking, look for shipping damage that could later have an adverse effect on function and safety.
- Use only proper tools to avoid the risk of accident and damage to the contents.
- Each crate is secured with metal strapping. There is **serious risk** of accident, particularly **for eyes**, when cutting the straps. The cut ends can lash back unexpectedly.
- Pull only nails out of the crate boards that have a cardboard or metal disk under the heads.
- Pull nails out completely and dispose of them properly. Wear sturdy shoes.
- Always observe the directional markings on the crates during transport, storage and unpacking.

Work in connection with voltage

No work may be performed on current-conducting parts (>50 V ~ or >120 V-). The system must be de-energized by means of the EMERGENCY OFF switch.

This prohibition does not apply for measuring and adjustment procedures. Be careful when performing these procedures. Use only tools and measuring instruments, which are suitable for the respective procedure. Test and adjustment points must be accessible without any risk of injury for personnel. If this is not possible, switch off the system.

If voltage must be applied during an operation, e.g. to perform unit movements, please pay particular attention to any danger due to moving and rotating parts.

De-energize the unit immediately afterwards.

Body protectors

If there is any risk of injury, body protectors must be used. It is essential to observe the notes given in the documentation.

Radiation protection

Ionizing radiation can lead to radiation injuries if handled incorrectly. When radiation is applied, the required protective measures must be complied with in any event.

Replacement of damaged or missing Installation Hardware

Damaged or missing installation hardware (such as steel cables, washers, etc.) may be replaced only with original parts.

Mandatory reporting

The supervisor in charge must be notified at once in the event of an accident or if there are any hazards which may cause an accident.

For this, please observe the corresponding instructions.

⚠WARNING **For activities in the product danger zones, there is significant risk of injury that can be caused by unintentional unit movements. Press the service or EMERGENCY STOP switch.**

Screw connections

Tighten torque for screw connections

All existing screw connections must be tight sufficiently firmly, but they must not be overstressed when tighten.

The stated torque must be complied with in any event!

NOTICE All screws must be secured in accordance with the corresponding data. If "Loctite" has to be used to secure screws, this is stated in the text.

Replacement of damaged or missing screws

Damaged or missing screws may be replaced only with the same screw types that have the specified hardness rating.

Unless a different value is listed in the instructions, all Allen screws used must be hardness rated 8.8.

Batteries

For replacement of batteries, special preventive measures apply.

In the case of lithium batteries, there is as risk of explosion if they are incorrectly installed.

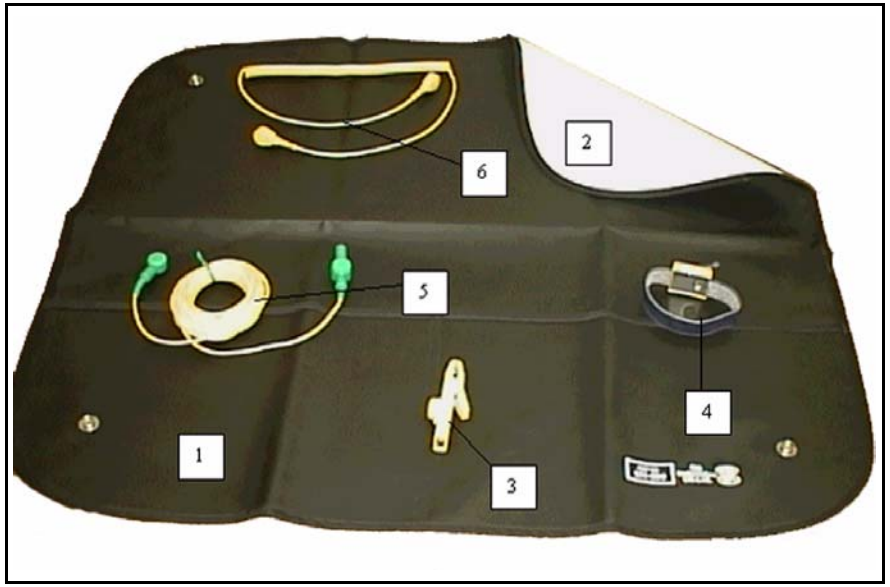
The notes concerning handling and disposal must be observed in each case.

Protection of electrostatically-sensitive devices

The used integrated circuits and PC boards, which are equipped with electronic modules, require especially careful handling because of their electrostatically very sensitive structures and their extremely high input impedance.

Use the prescribed means of protection.

Fig. 2: Electrostatically sensitive devices



LEGEND: 1 Conductive side of the mat; 2 Dissipative side of the mat; 3 Crocodile clip for each bonding to ground; 4 Bracelet for ground connection of the service operator; 5 Cable to connect mat to ground (by crocodile clip); 6 Cable to connect mat to bracelet.

Transporting the System

⚠**WARNING** **A licensed carrier should perform all transport activities including delivery of the magnet and the System components into the MR-suite only.**

Handling heavy loads

Apart from wearing the required protective clothing, e.g. safety boots and gloves, care must be taken that heavy loads are correctly lifted/carried to avoid injury to health (e.g. injuring the spine).

The relevant instructions must be complied with.

Heavy or awkward loads must be moved by mechanical means or by several persons.

Always

- Wear protective clothing, such as non-magnetized safety shoes
- Inspect tools for visual damage prior to using them The tools and auxiliary tools must be in satisfactory working condition and meet with manufacturer's specifications (adhere to legal regulations).
- Inform the supervisor about incidents of damage
- Inform temporary personnel about the hazards and the safety measures to be taken when handling heavy loads
- Use only the transport and lifting devices specified
- Secure the transport device and load before moving the load

Never

- Use defective or damaged tools
- Block emergency exits
- Stretch ropes by twisting them
- Knot ropes or chains
- Stand under heavy loads
- Exceed the load capacity of devices
- Route or stretch ropes, chains, or bands over sharp edges
- Allow personnel to stay in areas where heavy loads are being moved

Laser radiation

According to its classification, laser radiation can lead to eye and skin injuries (Class 1 to 4); in addition, an extract from guideline ARTD-002.731.03.01.02, use must be in accordance with regulations:

- **Class 1:** not dangerous to the human eye
- **Class 2:** Laser units having a maximum output of 1 mW. The accessible laser radiation only lies within the visible region of the spectrum (400 nm to 700 nm). With short exposure times (up to 0.25 s) there is no danger to the optic-facial winking reflex

⚠**WARNING** **Class 3A: Laser units having a maximum output of 5 mW. The accessible laser radiation becomes dangerous for the eye, if optical instruments reduce the cross section of radiation. If this is not the case, the emitted laser radiation in the visible region of the spectrum, with short exposure times (up to 0.25 s), is not dangerous in the spectral regions, even for long irradiation times.**

Proper use must be observed. Required safety equipment must be used.

⚠**WARNING** **Class 3B: Laser units having a maximum output of 500 mW. Dangerous to the human eye and in particular cases to the skin. Proper use must be observed. Required safety equipment must be used.**

⚠**WARNING** **Class 4: Laser units having a higher output than 500 mW. Extremely dangerous to the human eye and dangerous to the human skin.**

Proper use must be observed. Required safety equipment must be used.

Handling hazardous substances

Hazardous substance is the designation for materials which can ignite or explode or which are toxic, injurious to health, corrosive or irritating. Their properties together with the hazards and protective measures connected with them are identified clearly by symbols and described by the instructions appertaining to the hazardous substances.

Before they are handled, these instructions must be read and the required protective measures must be complied with when performing work to avoid health risks.

In addition, all relevant instructions in the documentation must be complied with.

Working in the magnetic field

Only authorized personnel can carry out installation and service procedures in the field. The necessary service tools and non-magnetic tools must be used.

Care must be taken when using electronic measurement devices inside the magnet room. Refer to the measurement device's own User Manual to ensure that it can be used in magnetic fields.

Protective conductor measurement

Use the protective conductor meter and measure the impedance between the protective conductor connection on top of the line power distribution cabinet and an un-coated metallic part of the:

- RF room
- RF filter panel
- Console and Monitor
- Magnet

For further information refer to the Start-Up chapter of this manual.

Safety guidelines

Read first

All service engineers are required to comply with MR-specific safety information during planning/installing and servicing the System.

CAUTION	**Only Systems and components conforming to general safety requirements for medical devices according to DIN VDE 0750/EN 60601/IEC 601 series can be installed and operated in medical facilities.**

If ferromagnetic materials or tools are introduced into the vicinity of the magnet these objects will become projectiles that could be lethal to personnel working near the magnet.

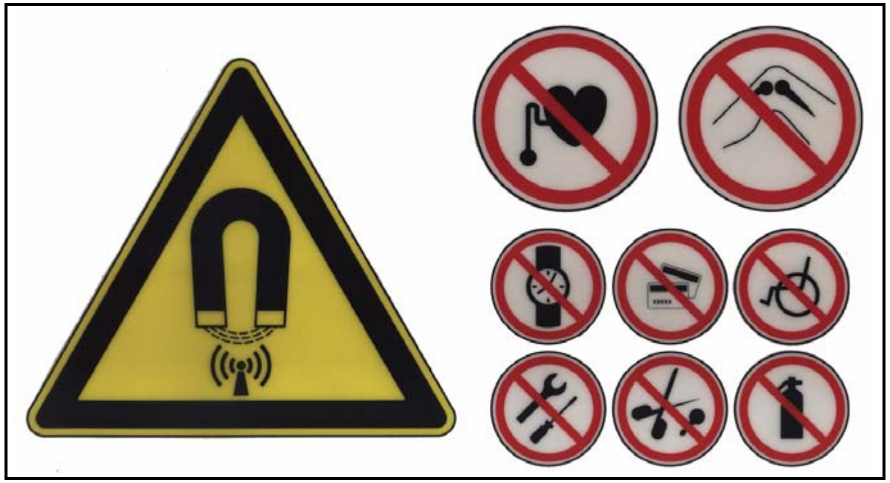
CAUTION	**It is the responsibility of the customer/user to ensure those patients with cardiac pacemaker implants or other implanted electronic devices remain outside the 0.5 mT (5 Gauss) exclusion zone. The exclusion zone must be identified by the user/customer and access to this zone must be restricted prior to installing the magnet.**

Location of warning/prohibitive signs

NOTICE	All signs must be posted at eye level, outside the examination room door, at the entrances to the MR-suite and on the 0.5 mT line. Make sure warning signs are clearly visible inside and outside the examination room.

Place the following label on the outside of the installation room front door.

Fig. 3: System label



Place the following labels on the outside of the pavilion door near the handle.

Fig. 4: Label code 8103047001

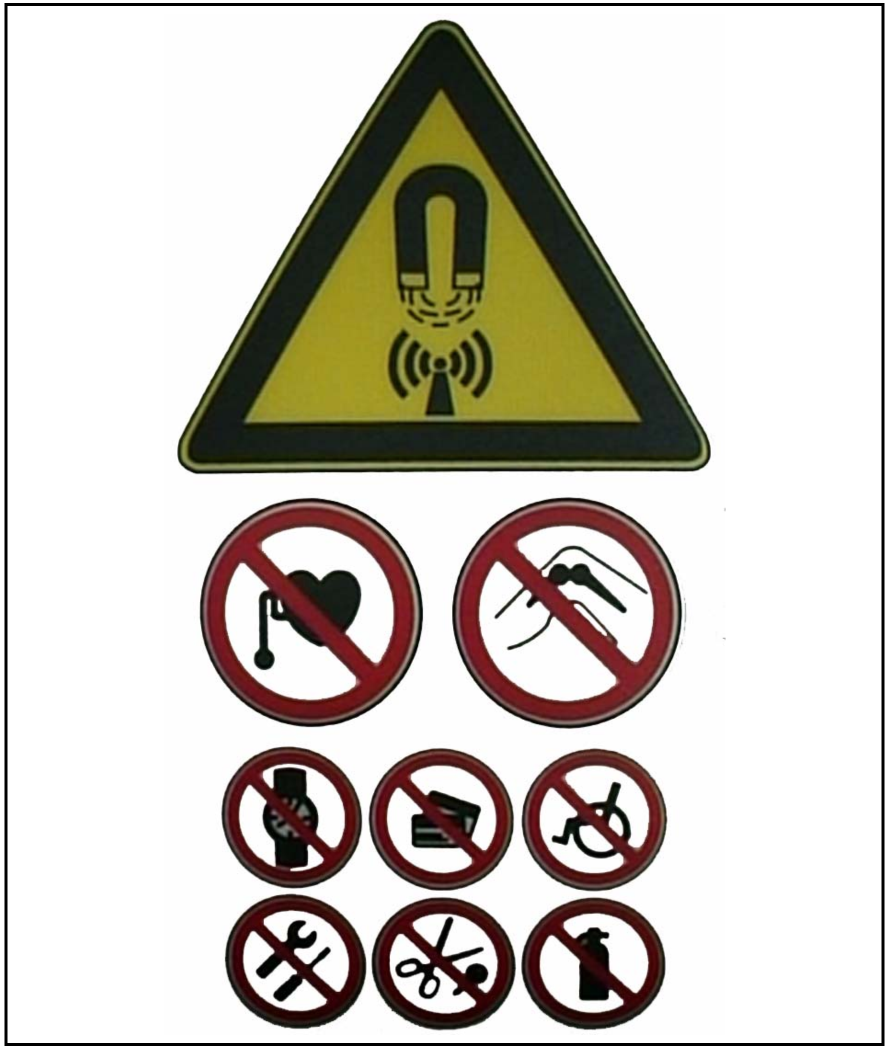
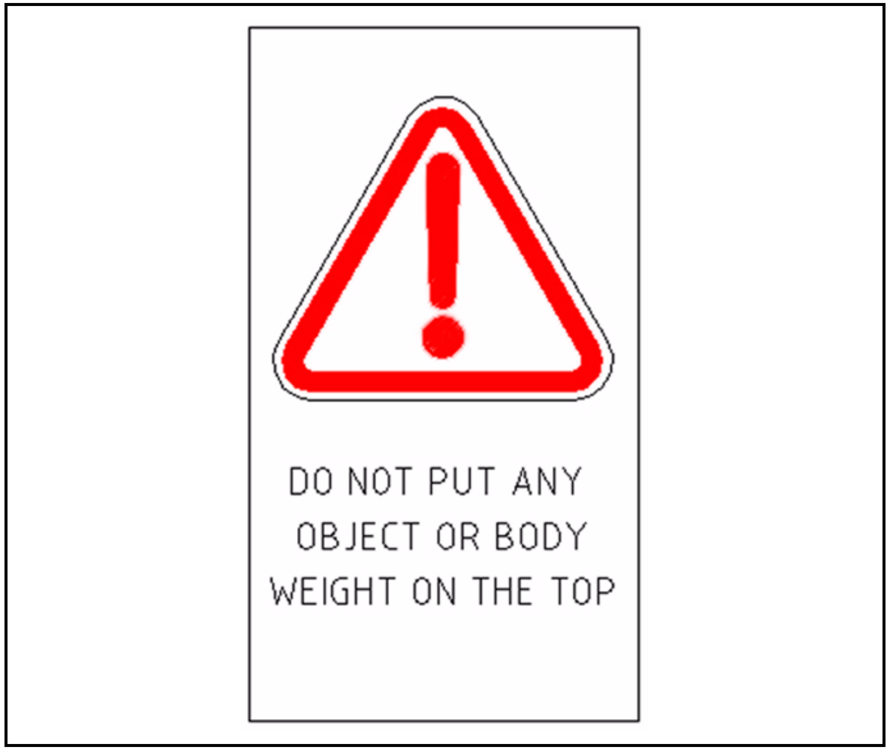


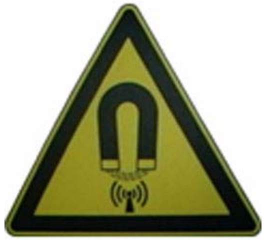
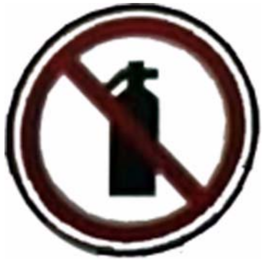
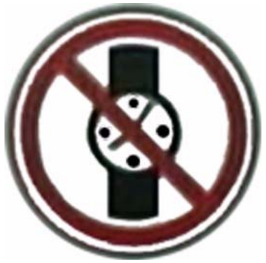
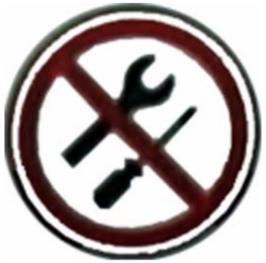
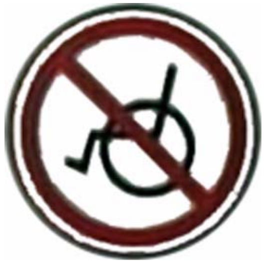
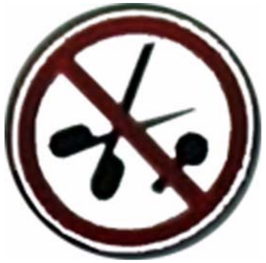
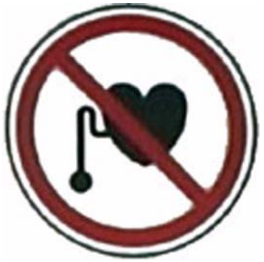
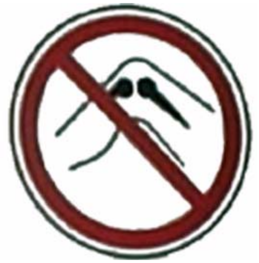
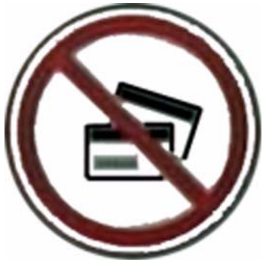
Fig. 5: Label code 8106297000



Precautions/restrictions implemented

- The project manager has informed employees working in the vicinity of the magnet about its pending installation
- The prescribed non-magnetized tools are available on-site
- Access to the magnet and examination room must be restricted as soon as a magnet is installed

Comply with the following signs

sign	meaning	sign	meaning	sign	meaning
	NMR MAGNETIC FIELD		No fire extinguishers with magnetized metal housing		No mechanical watches, electronic data carriers, such as pocket calculators, digital watches, etc.
	No metal tools of any kind		No wheel chairs or other kind of ferromagnetic objects used for patient transport		No metal parts of any kind
	No implants which may be affected by electromagnetic fields, e.g. CARDIAC PACEMAKERS, defibrillators, hearing aids, insulin pumps, drug pumps		No implants made of metal and other metal objects in the body, e.g. splinters		No data carriers such as credit cards, identification cards with magnetic strips, magnetic tapes

Phantom fluids

The functions of MR measurement phantoms require that they be filled with saline hydrous solutions. When the MR phantoms are used properly, operating personnel will not come into contact with the MR phantom fluid.

Solution ingredients

The phantom fluids contain the following ingredients:

NiCl + NaCl + distilled water

Handling and storage of phantoms

To prevent damage, the phantoms should be transported, stored or used at temperature levels between -5 °C to 50 °C.

Disposal and use of leaking phantom containers

The use of leaking phantoms is prohibited. Only authorized companies or customer service are permitted to dispose of the phantom fluid in compliance with the guidelines and safety instructions of the respective country (ARTD-002.731.20.01.02).

Cleaning up spilled phantom fluids

Only authorized companies or customer service are permitted to clean up spilled phantom fluids in compliance with the guidelines and safety instructions of the respective country (ARTD-002.731.2001.02).

Phantom fluids must not be flushed into sewage Systems. When cleaning-up, special protective clothing must be worn (disposable gloves made from rubber or other waterproof material, protective goggles, face masks including a filter against inorganic vapors).

Spilled fluid must be cleaned up using absorbent material, e.g. sand, wood shavings. If this type of material is not available, the spillage should be wiped up slowly and carefully with a cloth to avoid the release of aerosols. The absorbent material/cloth and the phantom fluid must be disposed of in a container. The same container is used for the water used to wipe down the contaminated area, the disposable gloves or the water used to rinse contaminated parts of e.g. lab coats or clothing.

First aid

If personnel come into contact with MR phantom fluids despite following the safety regulations, the following first aid measures apply:

In the event of contact with skin, the skin affected should be rinsed thoroughly with soap and water. The contaminated water must be poured into a bucket, the bucket labeled accordingly, and the water disposed of. Contaminated clothing must be taken off immediately and disposed of.

In the event of contact with the eyes, they should be rinsed for approximately 10 - 15 minutes under running water keeping the eyelids open. If aerosols are inhaled, the person should be moved immediately into the fresh air and a physician should be consulted.

If fluid is swallowed, the person should drink plenty of water and vomiting should be induced. A physician must be consulted immediately.

Part 3 System Installation

Pavilion installation

General Description

The Modular Shielding Pavilion is a shielding RF enclosure, which has no relation, except for its global size, with the installation room.

The shape and size of the pavilion are strictly related to the scanner and the operational space required.

No extra air conditioning and lighting are requested other than the ones already present in the room, provided that they comply with site specifications.

The pavilion is also able to partially screen the static and low frequency magnetic field fluctuation.

Specifications

Main characteristics

Tab. 1: Technical specifications

Feature	Data
Attenuation	70 dB (f_0 = 7 - 9 MHz)
Size	3.85 x 3.65 (±20 mm) x 2.34 m (outer dimensions excluding filter cover, ramp and door handles)
Shape	Straight rear and side walls; curved front side (door side see included drawing)
Doors	Two semicircular sliding shutters, width of the opening: 1.6 m. Necessary forces to move doors in the range of usual forces required to move, open and close shielding room doors less than 20 kg
Material	Aluminum metal sheet with holes (3 mm diameter at 5 mm distance); material thickness 1.5 mm
Weight	500 kg
Installation	From 2 to 3 working days
Site requirements	Maximum floor unevenness: 5 mm on 3 m. Room dimension sufficient to contain the modular shielding pavilion (minimum 4 x 4.5 x 2.4 m). Other specifications according with that required by the installation of the scanner.
Ground	Protective grounding of pavilion only by provided cable
Impermeability	Protection against corrosion 7 years
Permeability	Maximum temperature gradient between outside and inside during System operation: around 2 °C

The aim of the Radio frequency Shielding Pavilion is to protect the inner volume against external electromagnetic fields.

The Shielding Pavilion has been designed to shield a Nuclear Magnetic Resonance System with an open permanent magnet.

The external field's attenuation performance of the shielding Pavilion is greatly influenced by the type and state of the metallic contacts.

The advantages of this Pavilion can be summarized in the following table:

The geometric dimensions and the installation procedure for a standard Pavilion are given in detail below.

The main characteristics of the Shielding Pavilion are:

- Maximum height: 2340 mm
- Useful height: 2200 mm
- Maximum dimensions in plant: 3850 x 3670 ± 20 mm
- Total weight: 500 kg
- RF attenuation: 70 db at 10 MHz (H field) *
- Transparency (ratio empty/full): 32%

* Shielding effectiveness is defined as the ratio between the power incident on the shield and the transmitted power. In dB it is given by the relation Att [dB] = Pin (dBm) - Ptr(dBm).

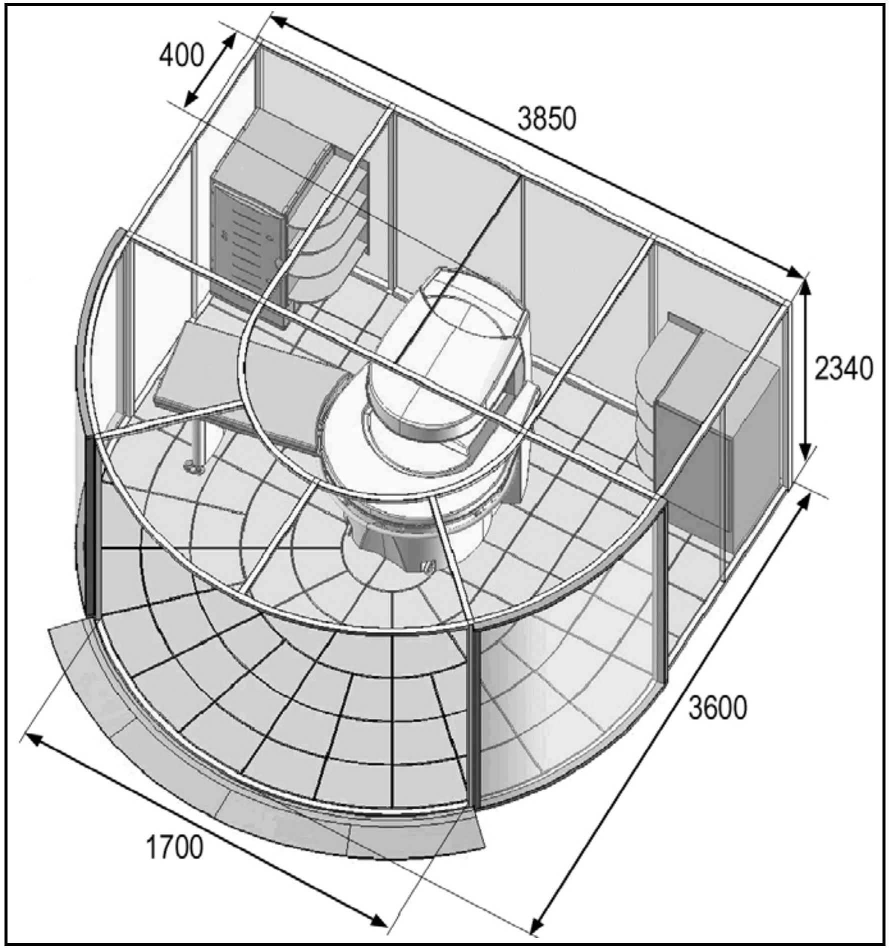
Shielding effectiveness is tested according to:

MIL STD 285 and EN 50147-1

The clear dimensions of the access opening of the Pavilion are 1600 x 2200 mm^2 and two sliding shutters form the relative door. Electric continuity is ensured by finger contacts partly placed on the frame of the sliding door and partly on the jambs of the fixed part. The contact between the sliding shutters is achieved through a finger-knife System on their doorstop surface.

Self-supporting wooden panels placed on steel panels covered with vinyl compose the floor of the Pavilion.

Fig. 6: Pavilion dimensions



Packing

The Pavilion's components are shipped in 3 wooden crates with the following characteristics:

Tab. 2: Crates size

Pavilion Number	Gross Size mm^3 (outside)	Tare [kg]
Crate N.1	3000 x 1100 x 650	130
Crate N.2	2550 x 1250 x 850	150
Crate N.3	2350 x 1100 x 950	135

In order to install the crate properly, we recommend opening the packages in this order: crate 1, crate 3 and crate 2.

Configuration choice

Before starting installation the operator must define the Pavilion configuration (central, left or right doors and filter panel left or right position).

Depending on the pavilion configuration refer to one of the installation diagrams attached.

- A: central door configuration
- B: left side door configuration
- C: right side door configuration

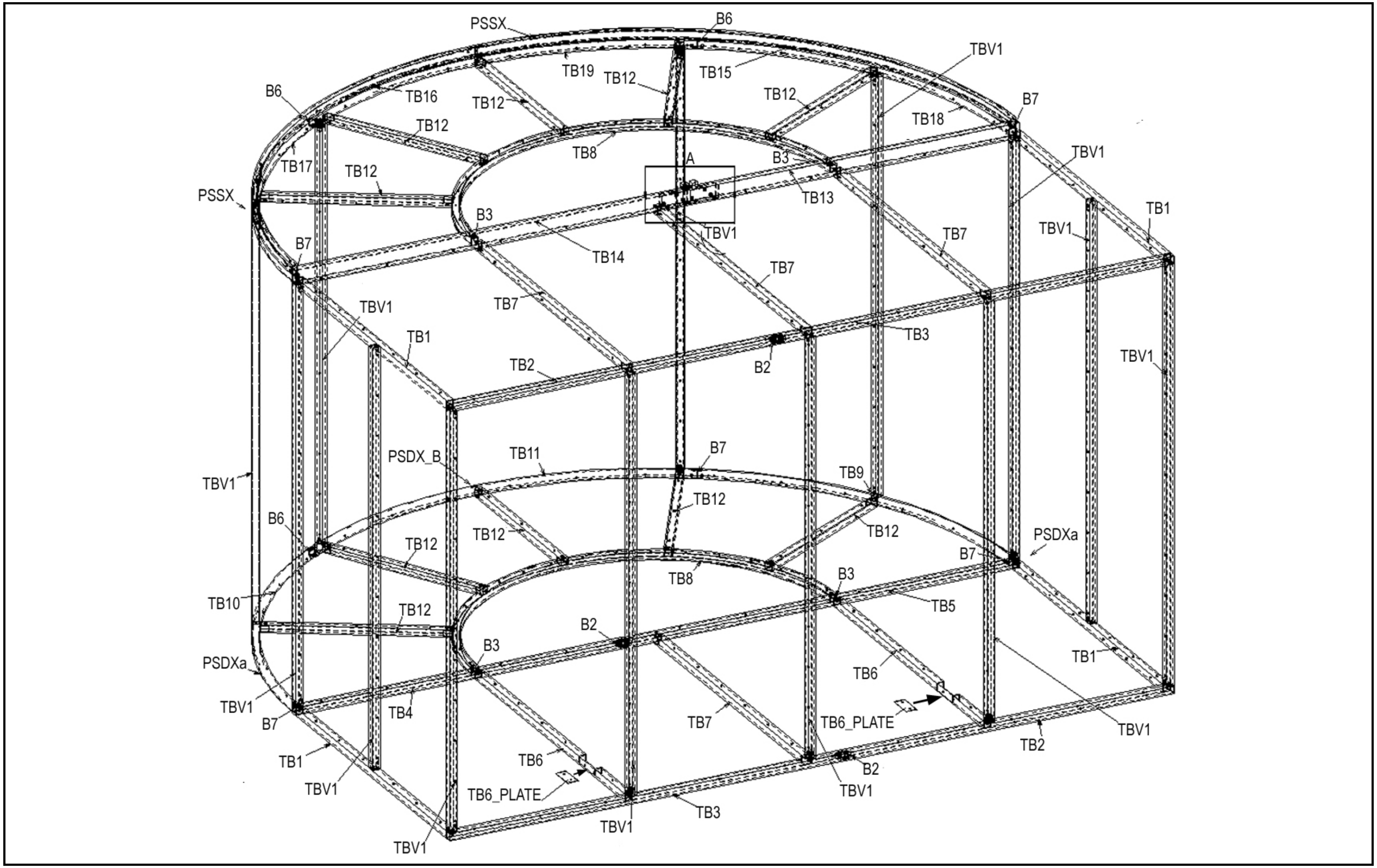
Mechanical installation

Only trained service technicians must perform the installation procedure.

Supporting structure installation

In the following figure the main components and how to assembly them are shown. The B2 element are shown in the following figures.

Fig. 7: Pavilion Main Components and Positions



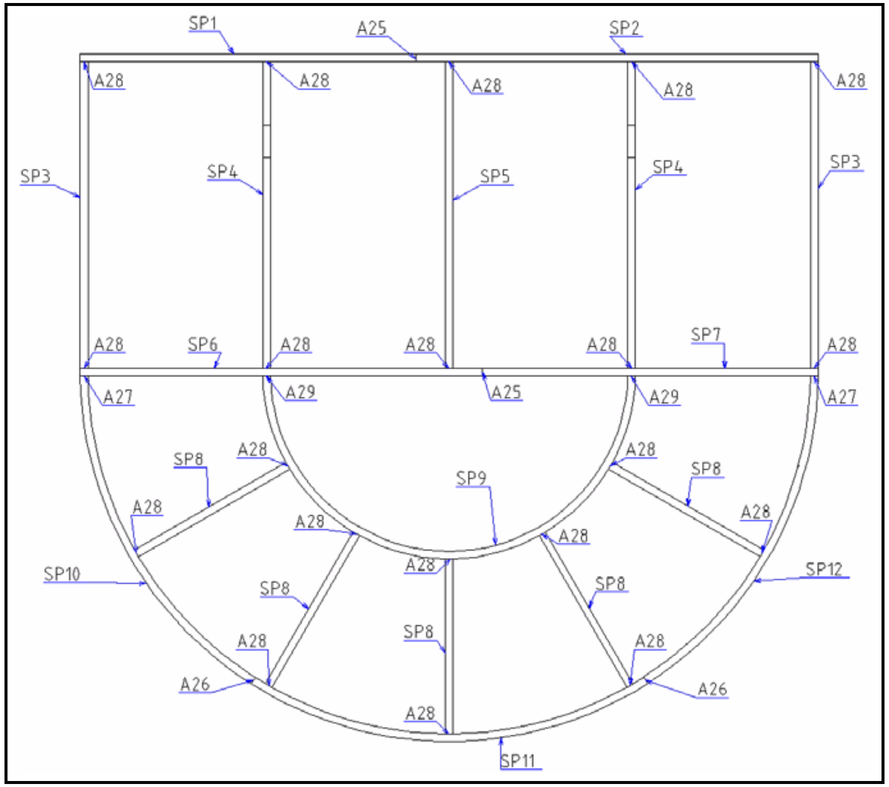
Floor supporting structure

Install the supporting structure starting from the floor components.

Place the components shown in the next figure on the floor.

Screw the coupling components, from code A25 to code A29, to the structural components of the floor (from code SP1 to code SP11) (see next figures).

Fig. 8: Floor assembling layout



The next figure shows how to assembly the B2 elements used to join the main Pavilion parts.

NOTICE	Before to proceed with the Pavilion assembling be sure to correct identify the A25, A26, A27, A28 and A29 components and their correct locations!

Fig. 9: How to join the Pavilion B2 components

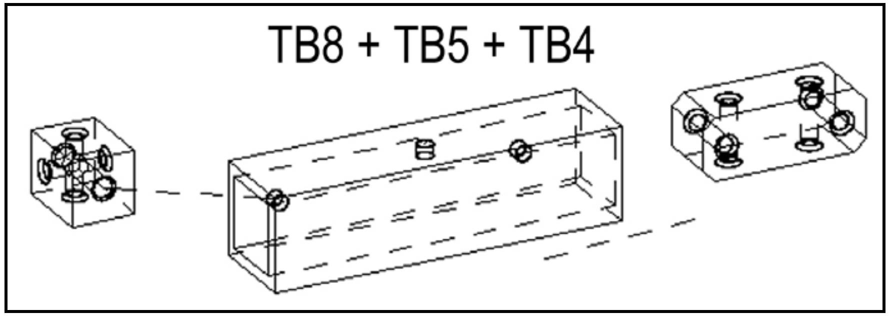


Fig. 10: Joints

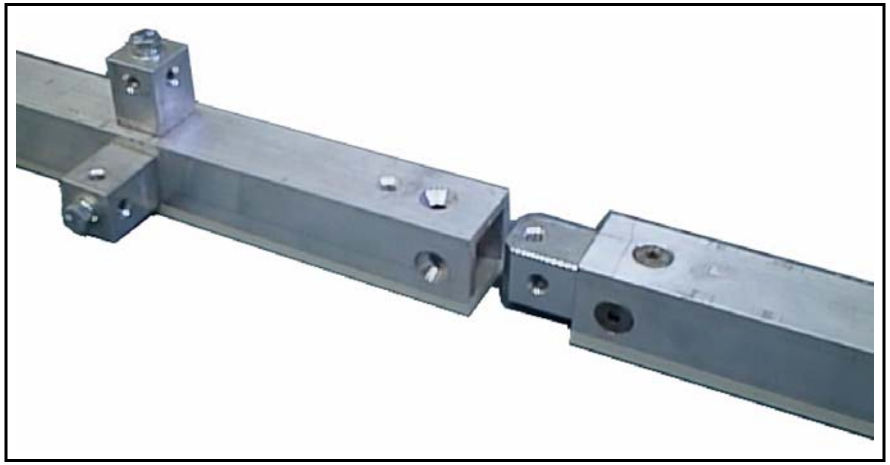


Fig. 11: Joints

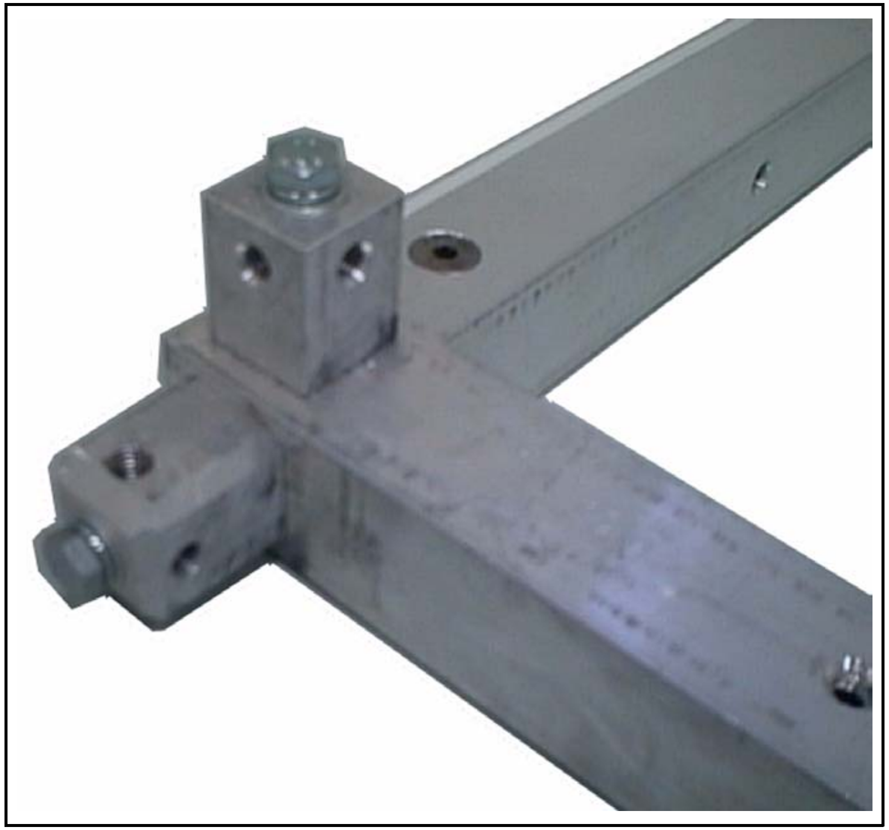


Fig. 12: Floor components assembling

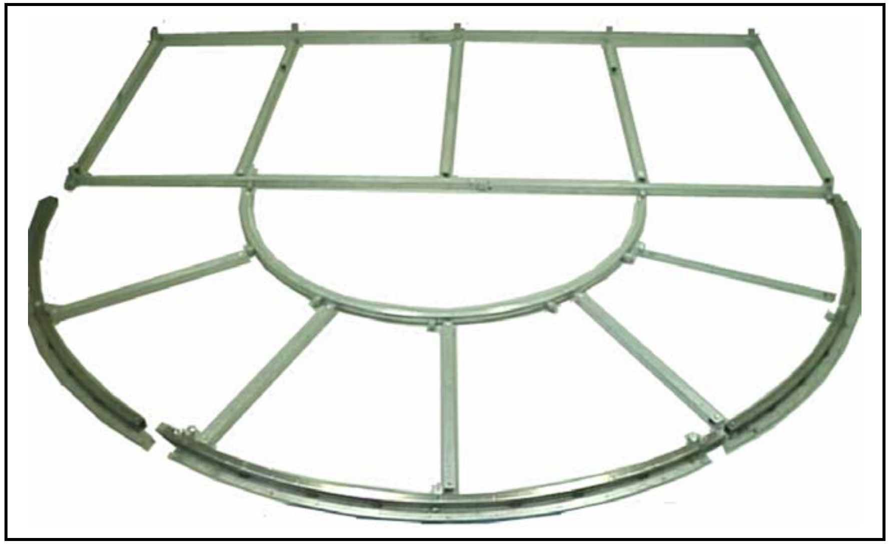
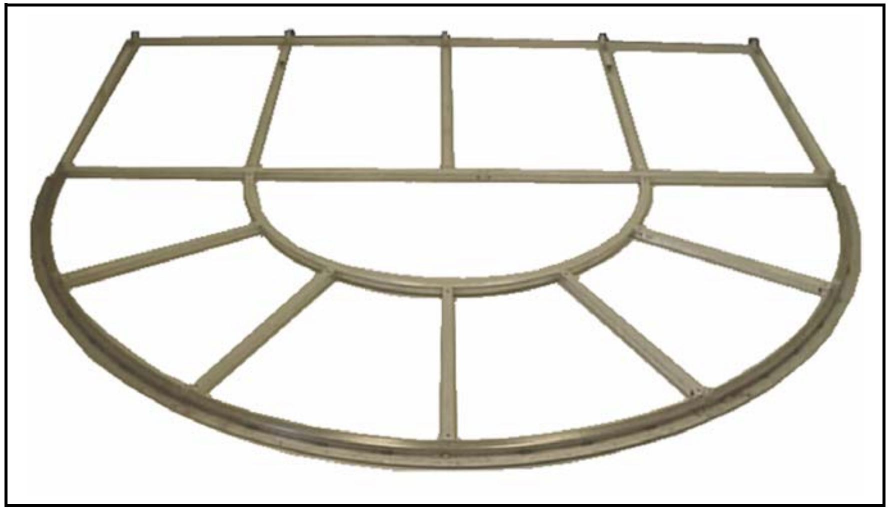


Fig. 13: Floor components assembled



Vertical supporting structure

On the assembled floor, place the vertical studs as shown in the next figure using the joints on the base parts. Take care that the SV1 components must be used in the Pavilion lateral and rear side while the SV2 components must be used in the Pavilion front side.

Fig. 14: Vertical stud positions for central door configuration

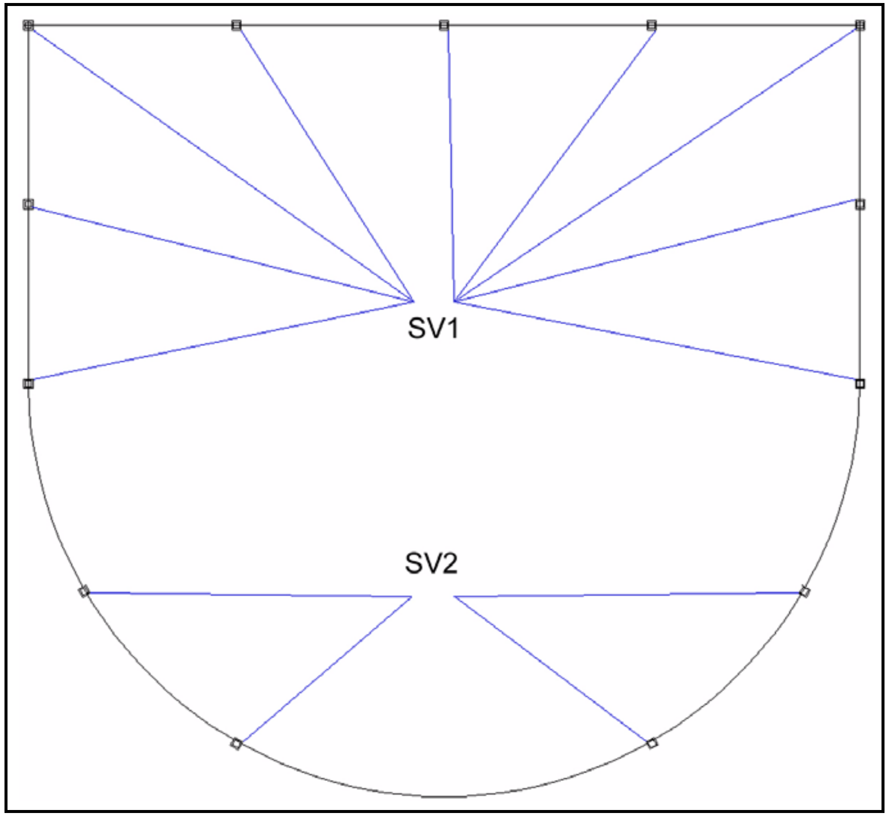
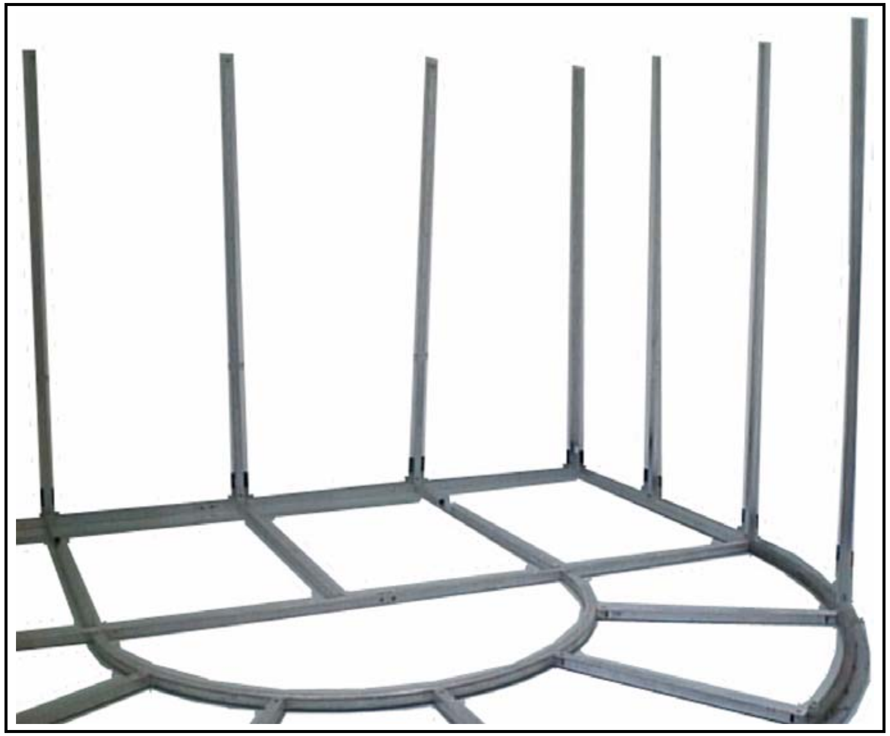


Fig. 15: Vertical stud assembling



Ceiling supporting structure

Join SS5 and SS6 components shown in the next figure, using two slab accessories A32. Then fix the joining blocks (code A28) in the positions indicated in the next figure. At completion of supporting structure, tight all the screws with a 5 Nm moment, except those belonging to the vertical SV2.

Fig. 16: Ceiling support structure assembling for front door

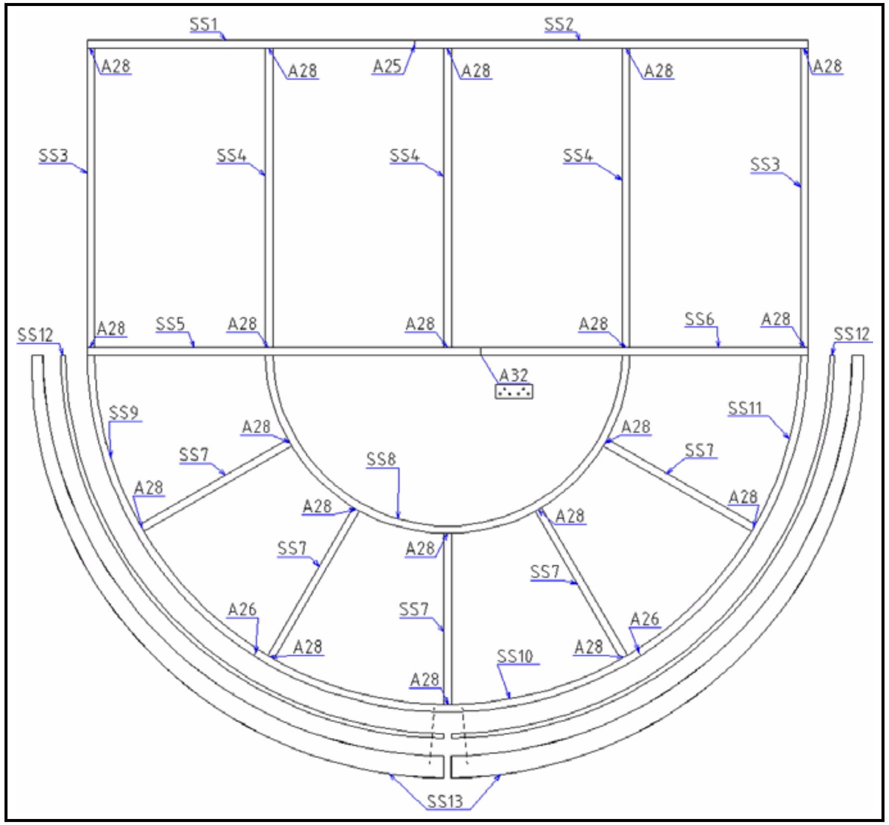


Fig. 17: Ceiling Main Support

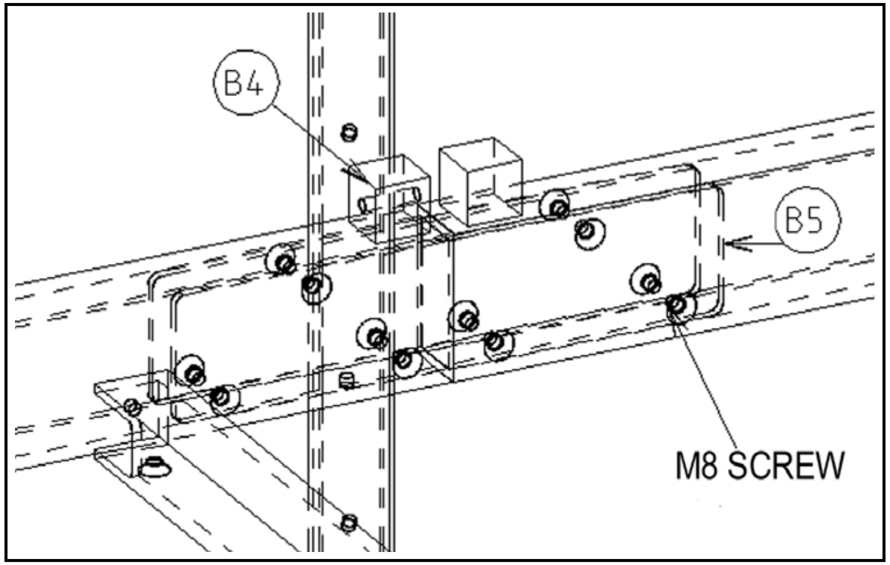


Fig. 18: Ceiling Support

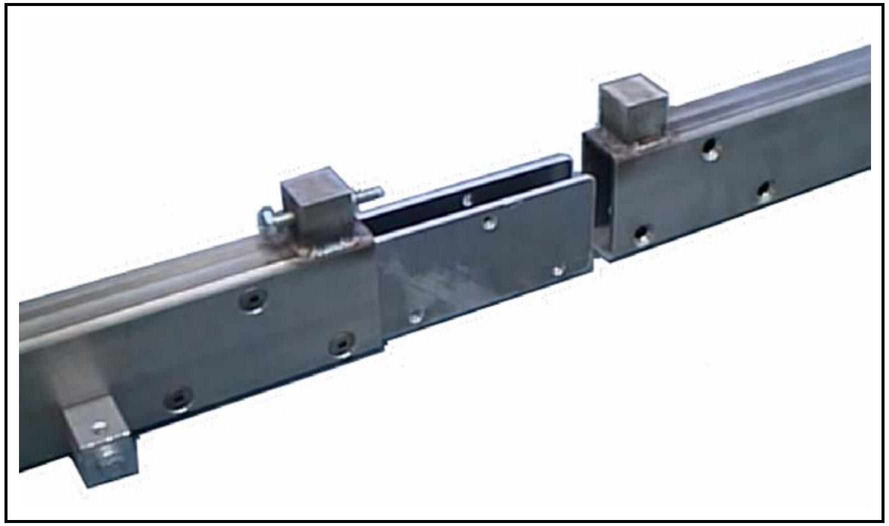


Fig. 19: Ceiling Support

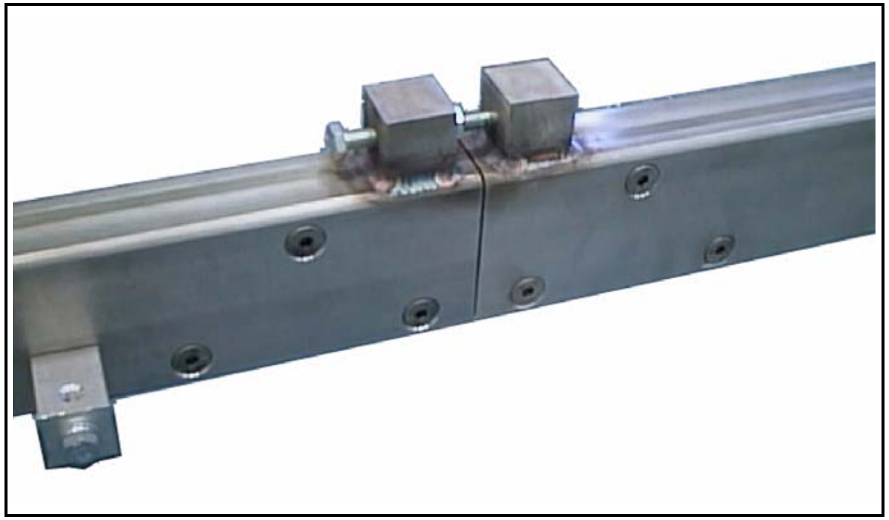


Fig. 20: Ceiling Support Positioned

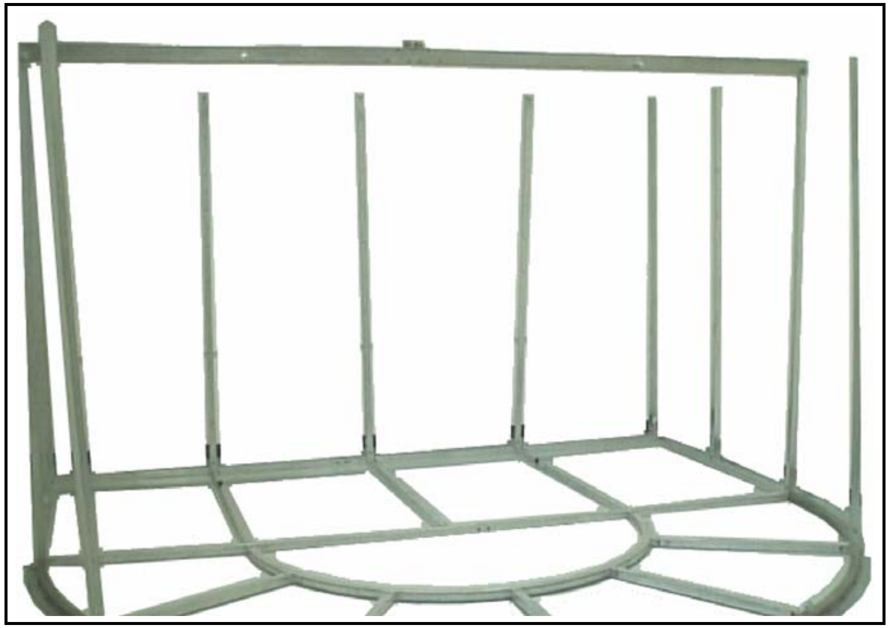


Fig. 21: Ceiling Assembling

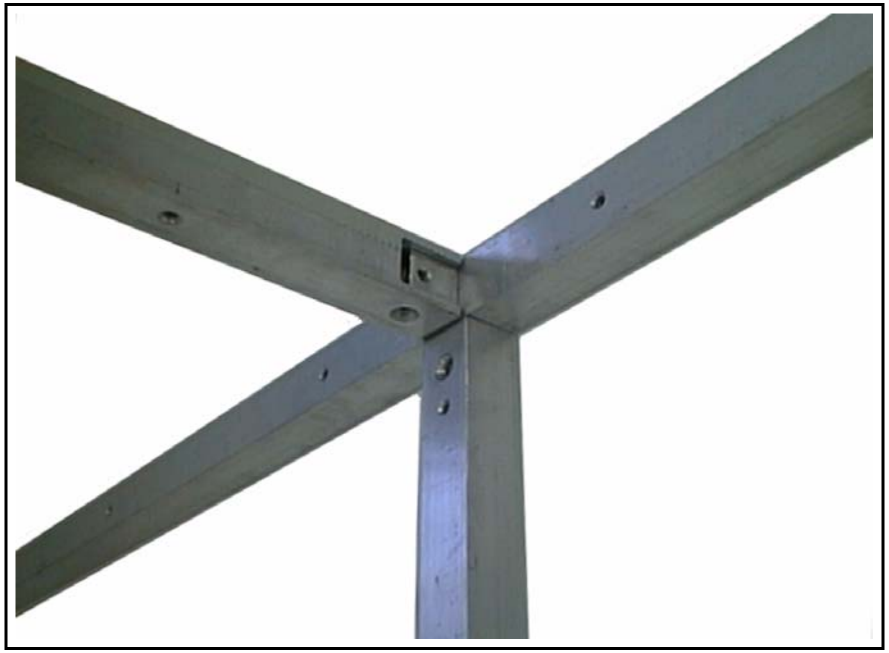


Fig. 22: Ceiling Assembling

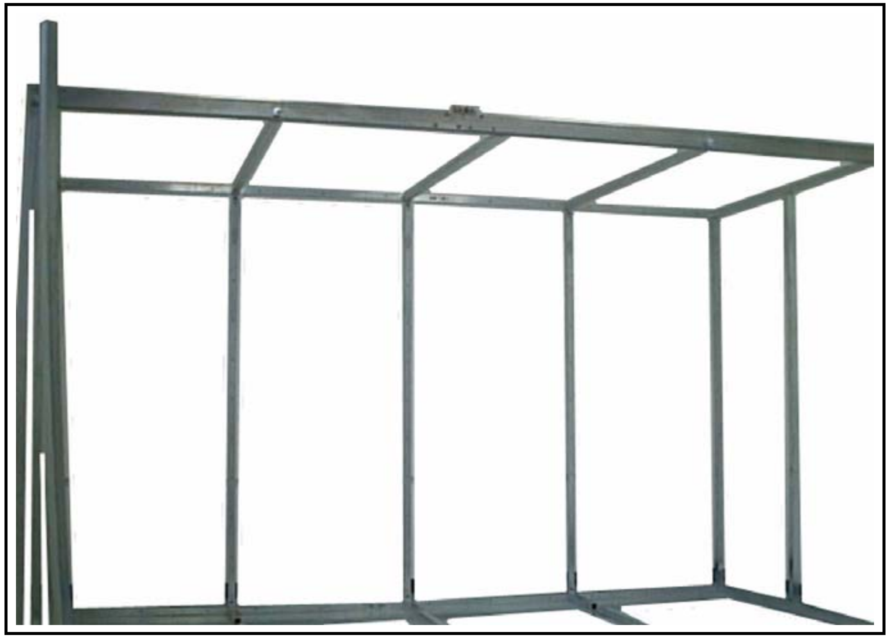


Fig. 23: Ceiling Assembling

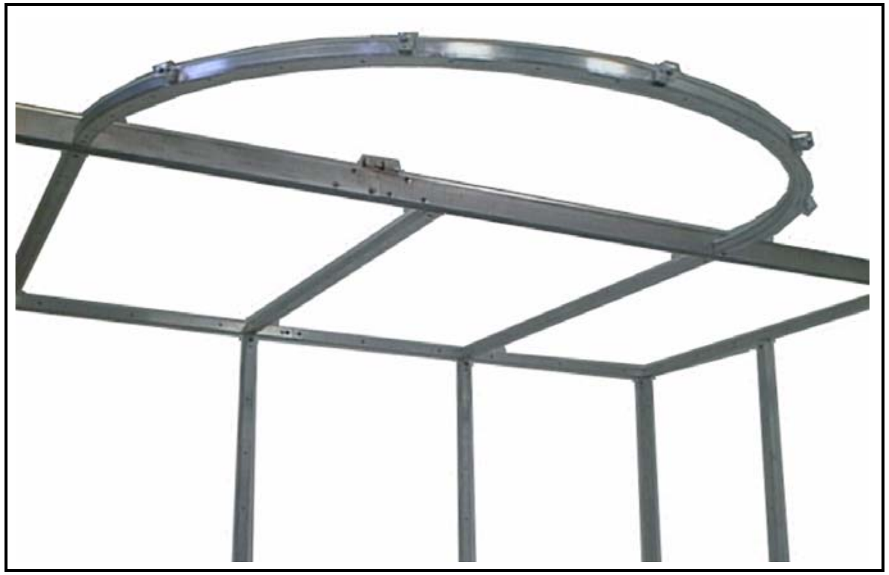


Fig. 24: Ceiling Assembling

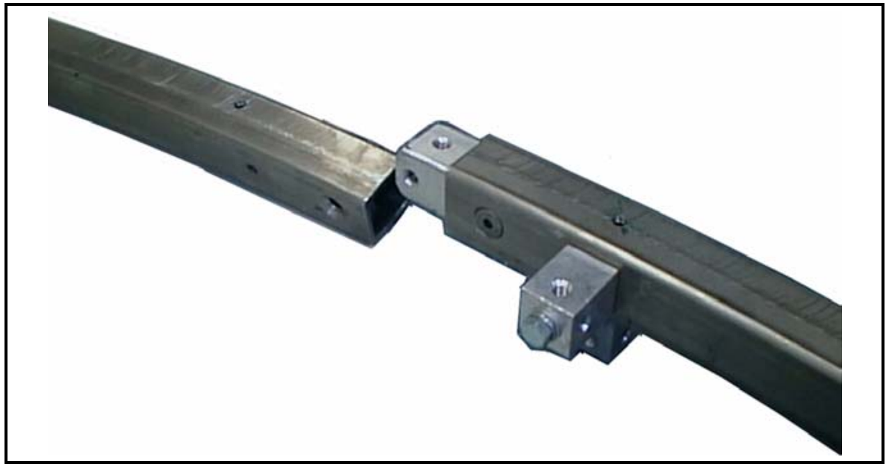


Fig. 25: Ceiling Assembling

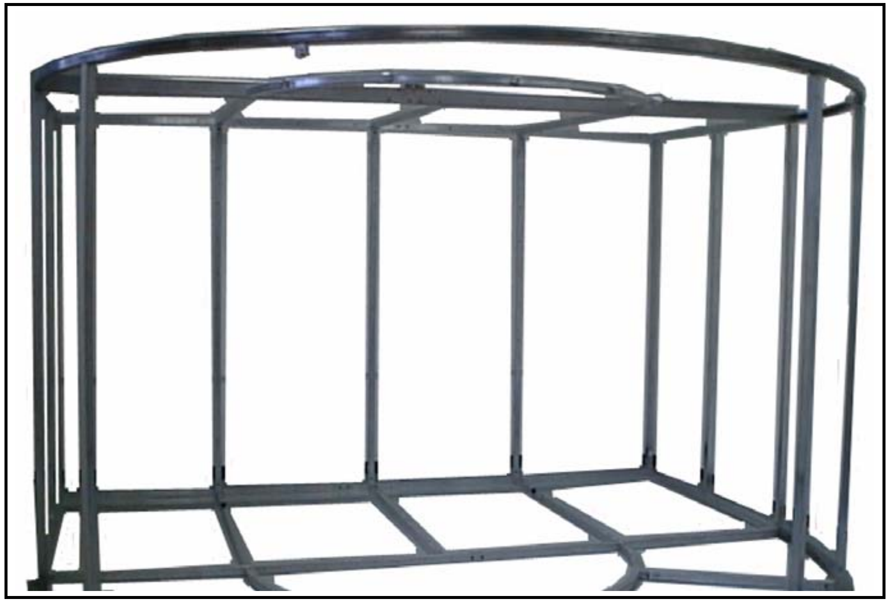


Fig. 26: Ceiling Assembling

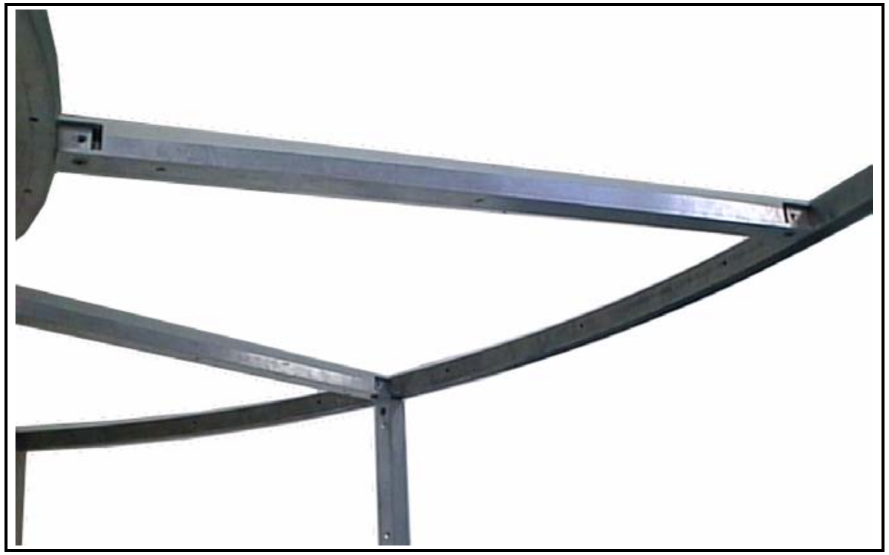
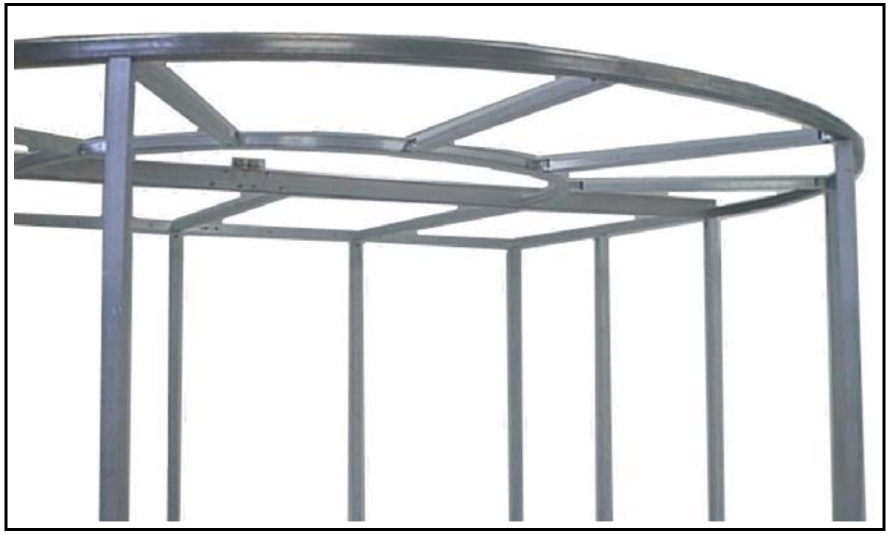


Fig. 27: Ceiling Assembling



Upper track

Install on the upper curved part components SS12.

On the previous components, mount the pieces SS13 and then place the upper rails A12 and A13.

These components can be seen in the next figures.

Fig. 28: Upper Track Assembling

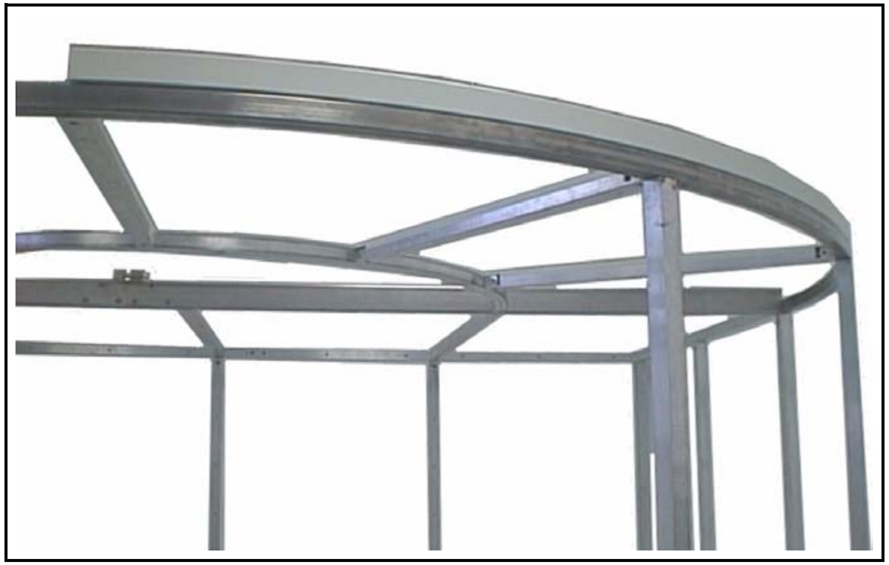


Fig. 29: Upper Track Assembling

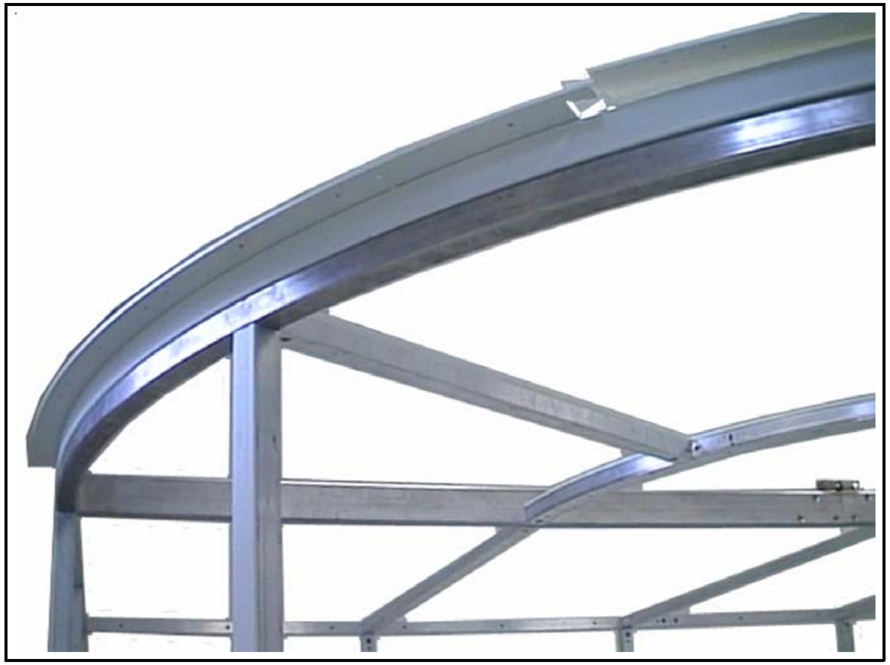


Fig. 30: Upper Track Assembling

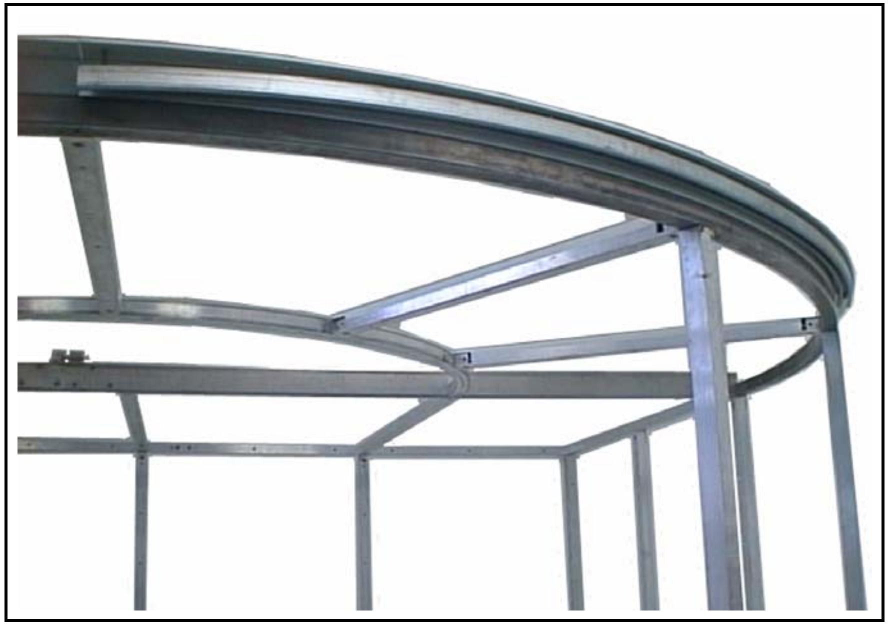
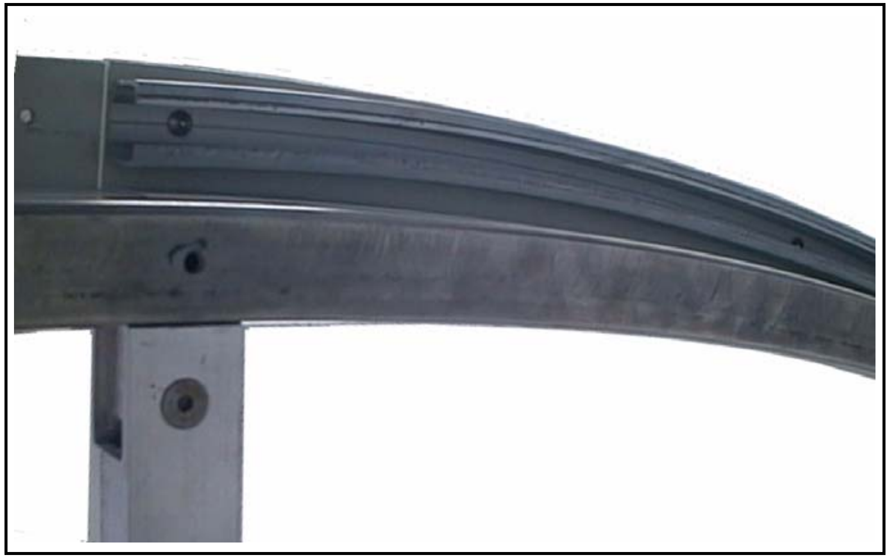


Fig. 31: Upper Track Assembling



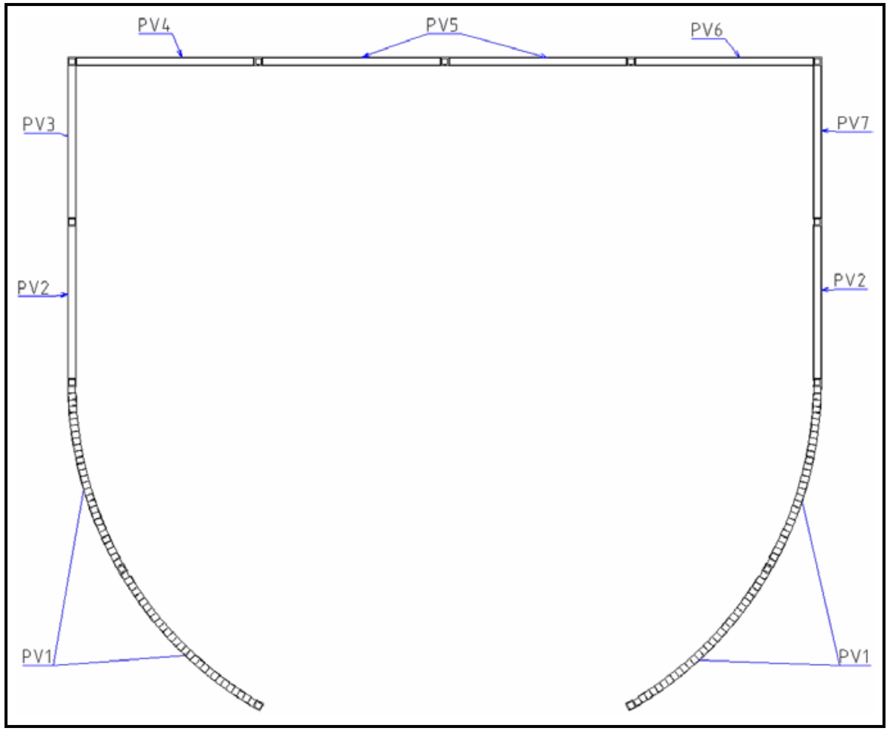
Panel Installation

Start installing the panels to the supporting structure from the wall sides. Then, install ceiling panels and finally floor panels. Before installing the panels, you must define the position of the penetration panel. The attached installation schemes refer to the left penetration panel configuration.

Follow this procedure to the panels:

- Place the side panels in the order indicated in the next figure
- Place the panels in the proper spaces
- Fix each pair of adjacent panels to the supporting structure using the proper temporary anchoring Systems (specially installing the ceiling panels)
- Place the lateral side panels taking care that the corner panels (PV4 and PV6) and the panel with the hole for the penetration panel (PV3) are different then the others and must be set in according with the system configuration

Fig. 32: Lateral Panel Layout



The next figures show some details of the side panels and their assembling.

Fig. 33: Corner Panel Assembling

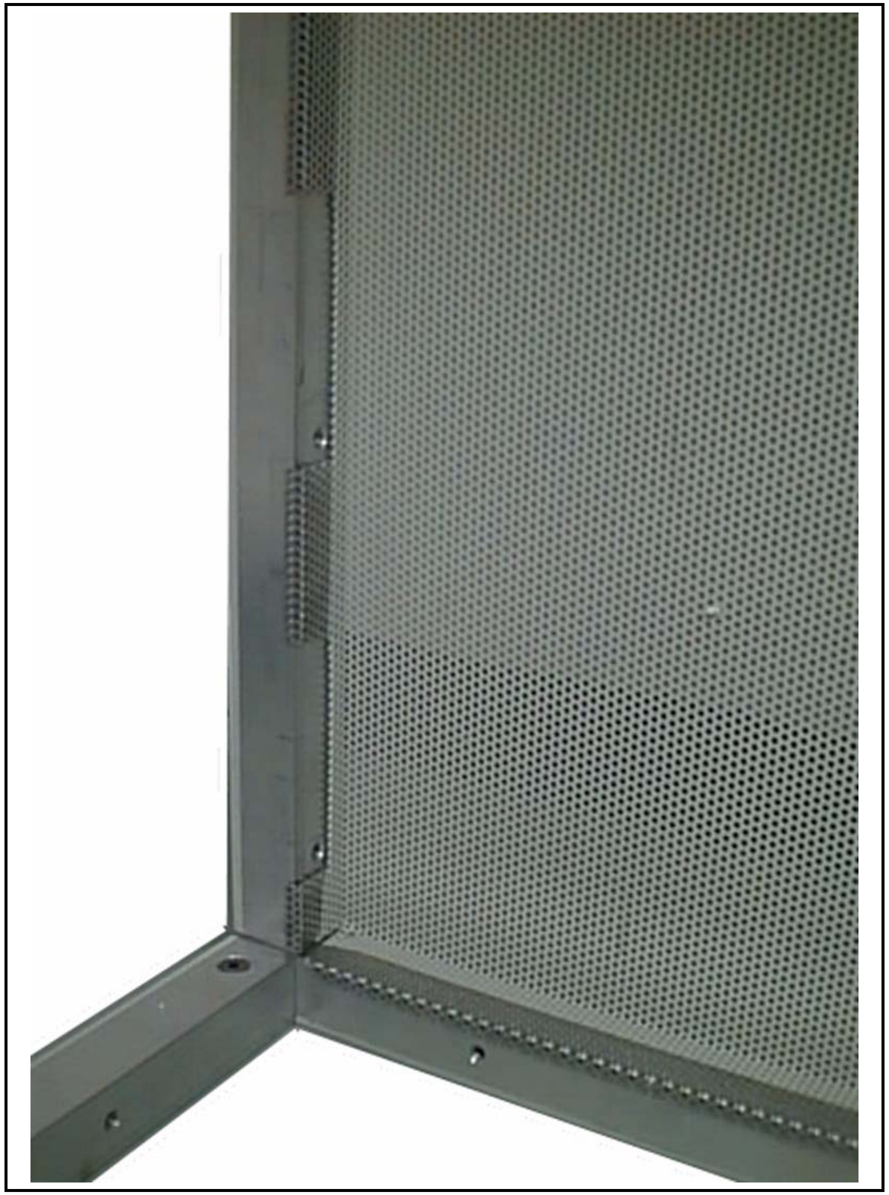


Fig. 34: Floor Panel Layout

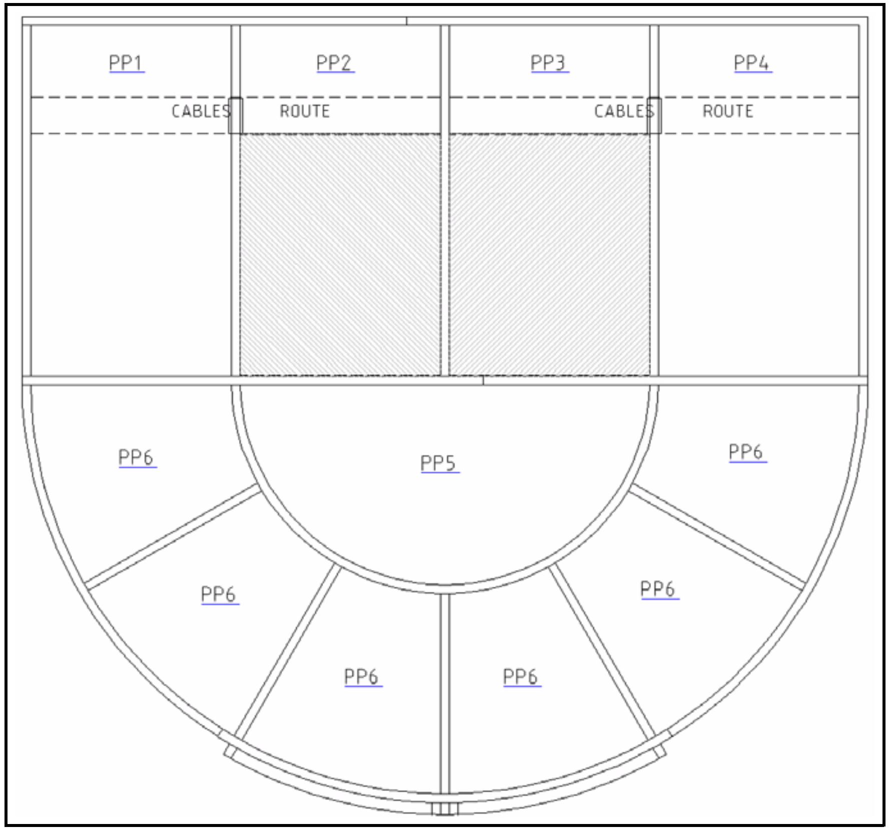


Fig. 35: Panel Assembling

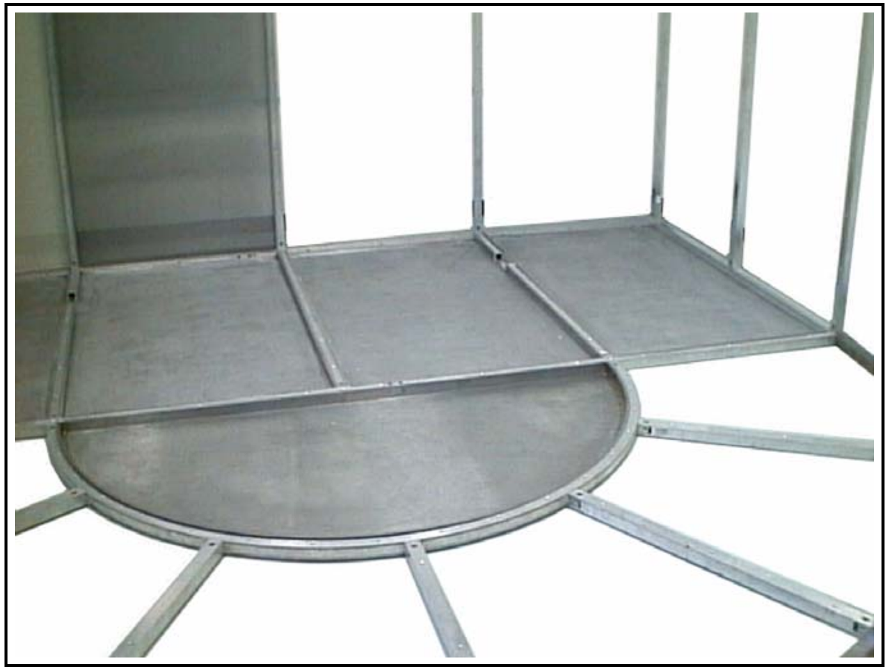


Fig. 36: Panel Assembling

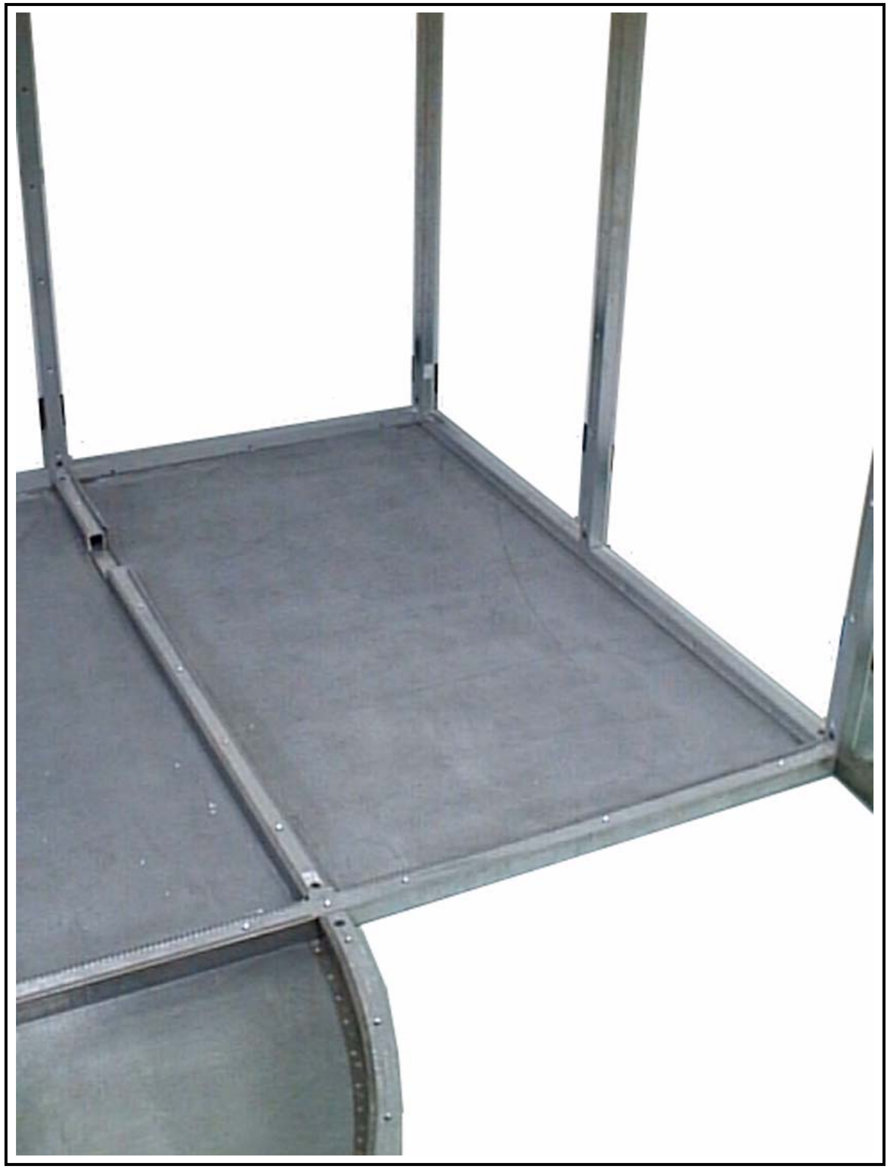


Fig. 37: Panel Assembling and stainless steel reinforce plates

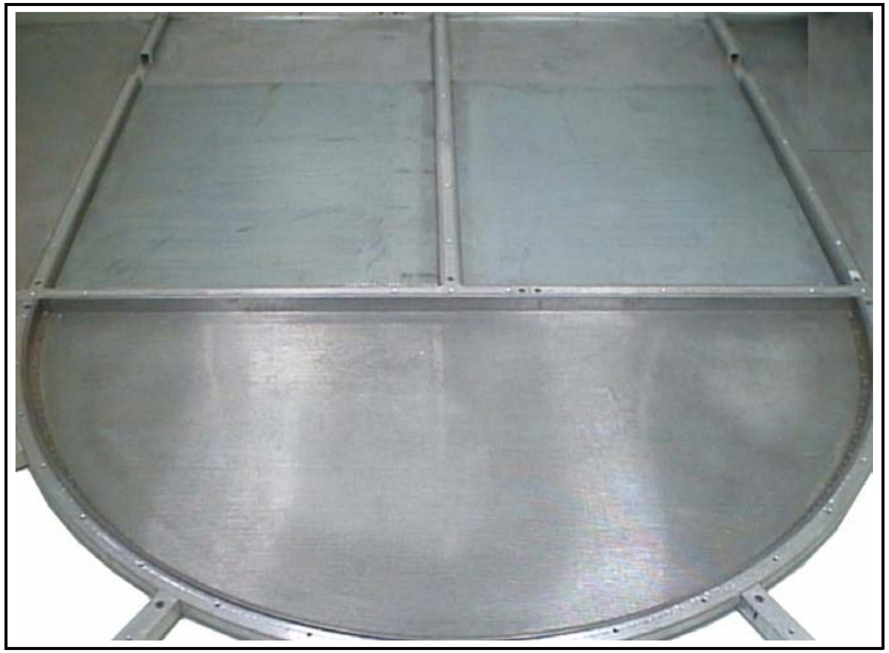


Fig. 38: Panel Assembling

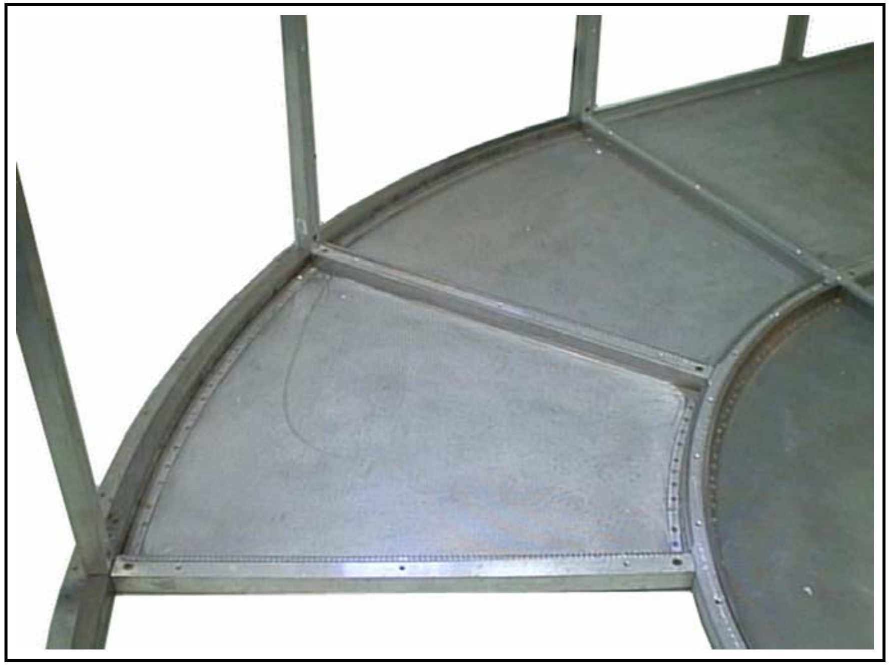


Fig. 39: Panel Assembling (right corner)

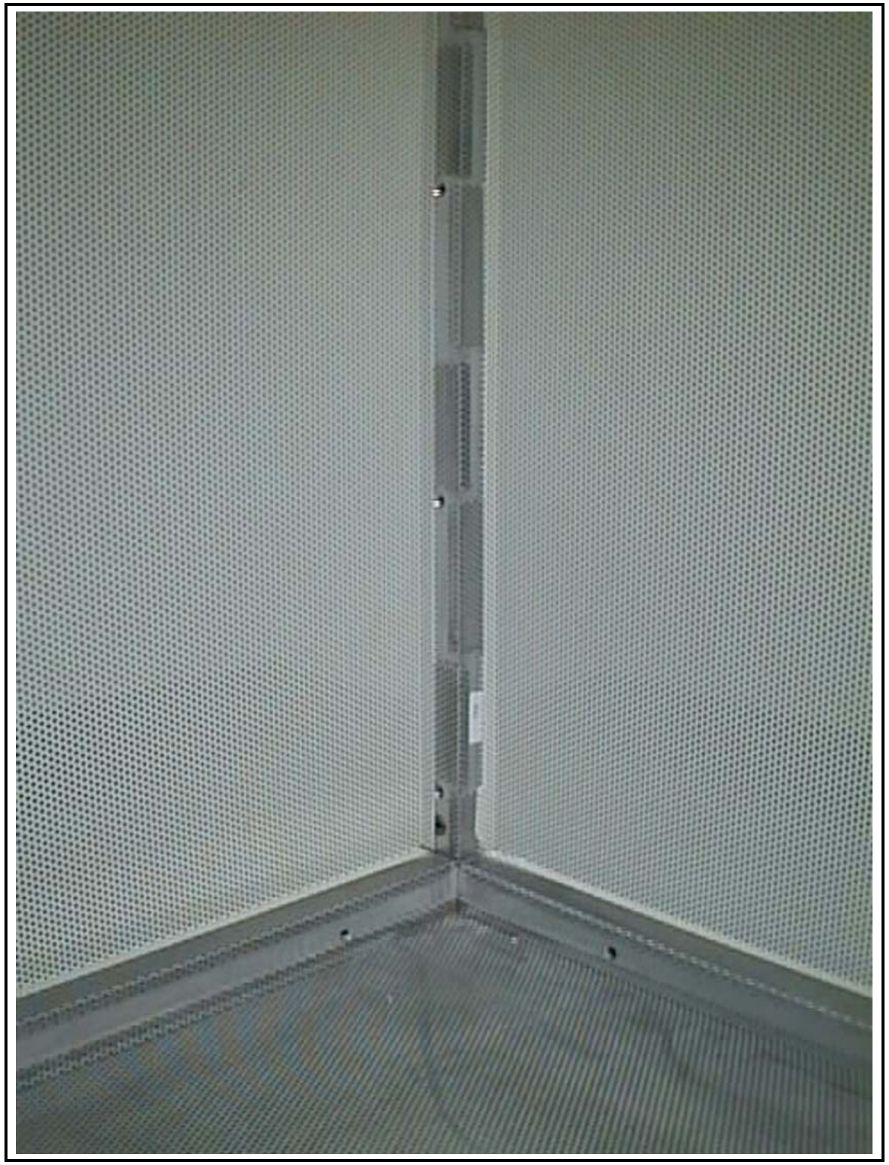


Fig. 40: Panel Assembling and left penetration panel position

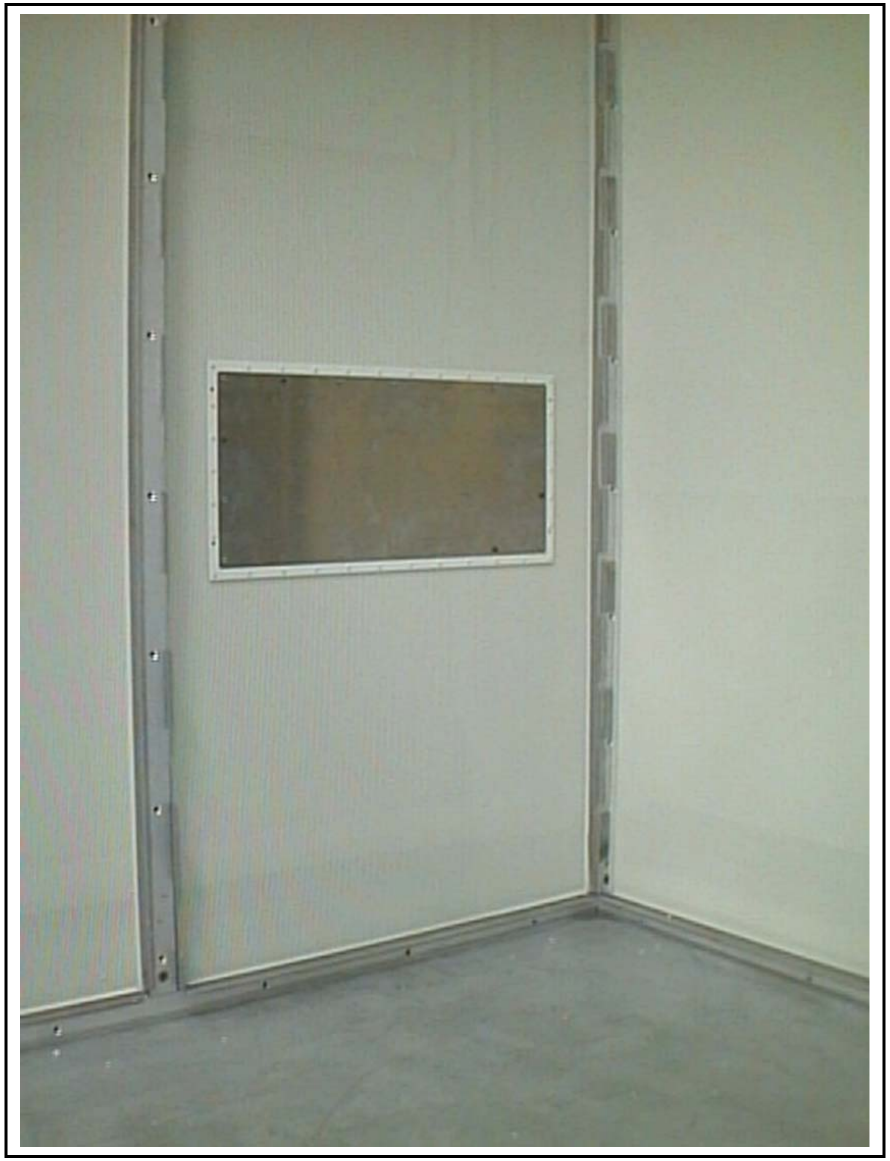


Fig. 41: Panel Assembling

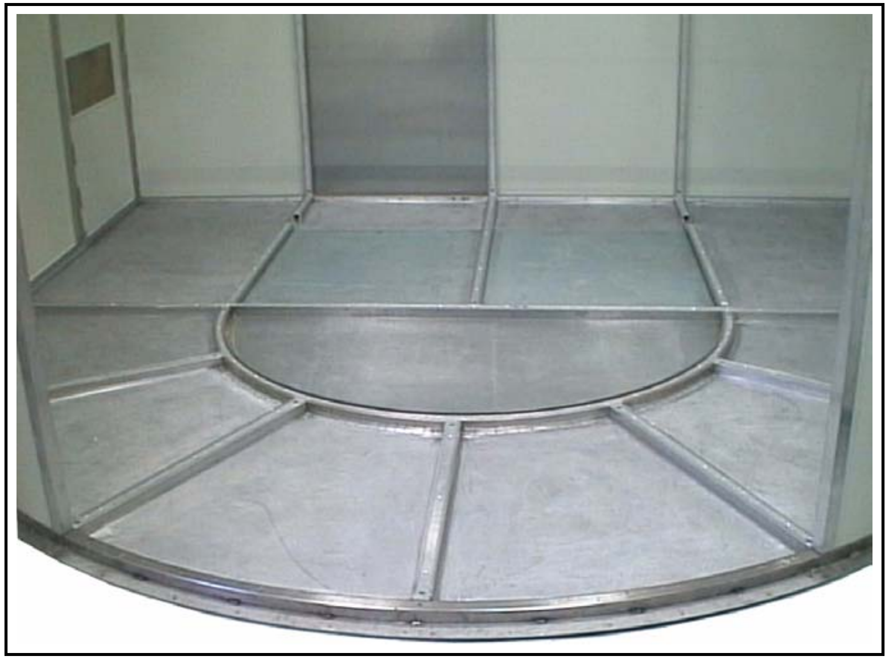


Fig. 42: Panel Assembling

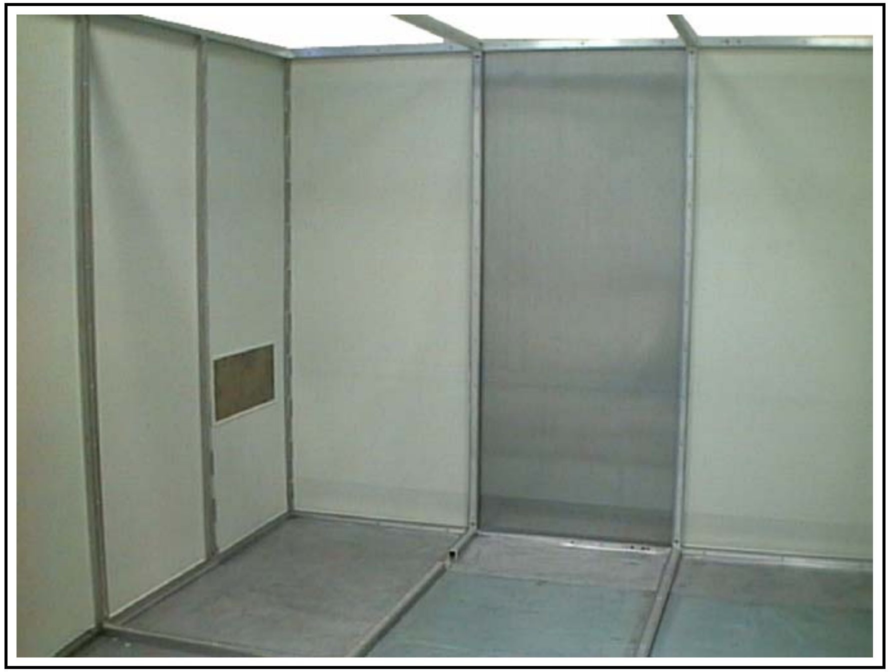


Fig. 43: Panel Assembling

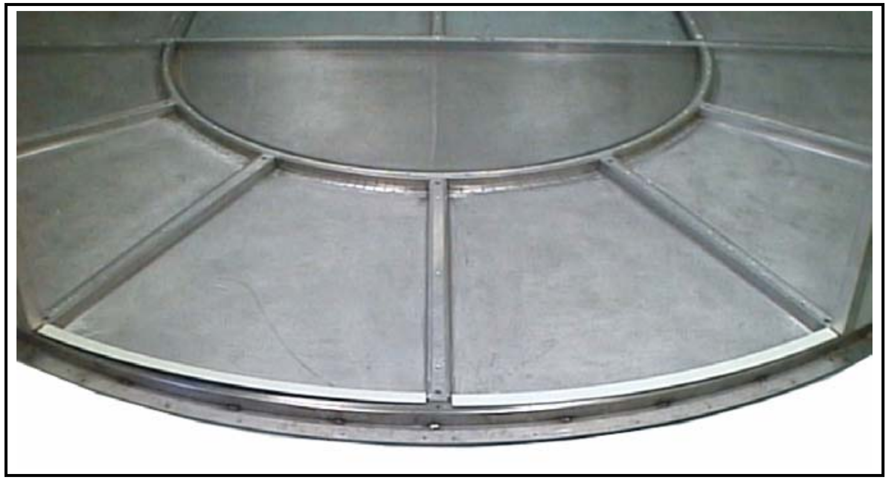
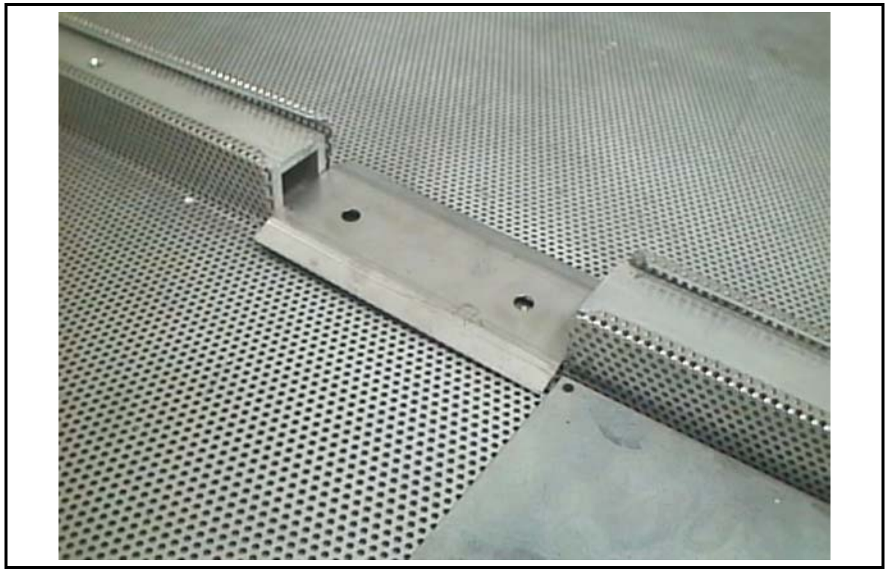


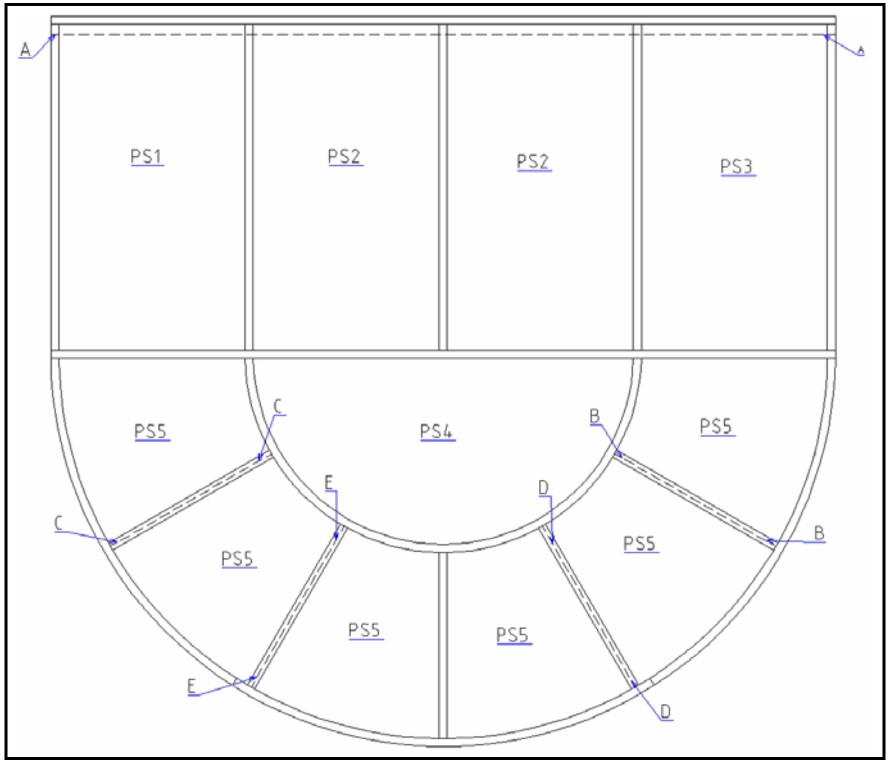
Fig. 44: Panel Assembling



Ceiling panels

- Place the ceiling panels in the order indicated in the next figure
- Join the panels and fix them to the supporting structure using the proper temporary anchoring systems

Fig. 45: Ceiling Panel Layout



⚠WARNING THE CEILING HAS NOT BEEN DESIGNED TO SUPPORT THE WEIGHT OF A PERSON. DO NOT STAND ON THE CEILING!!!

Fig. 46: Ceiling Panel Assembling

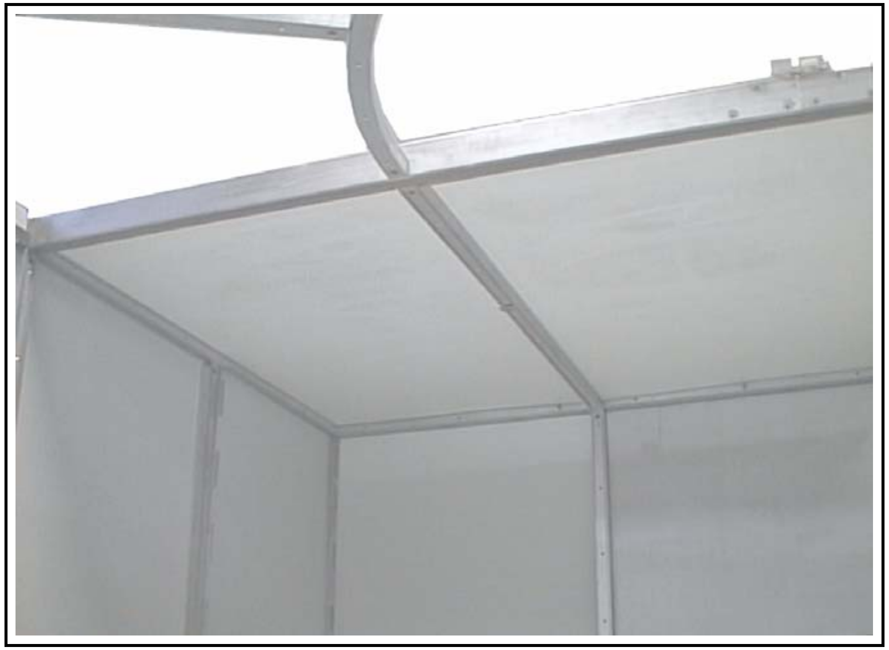
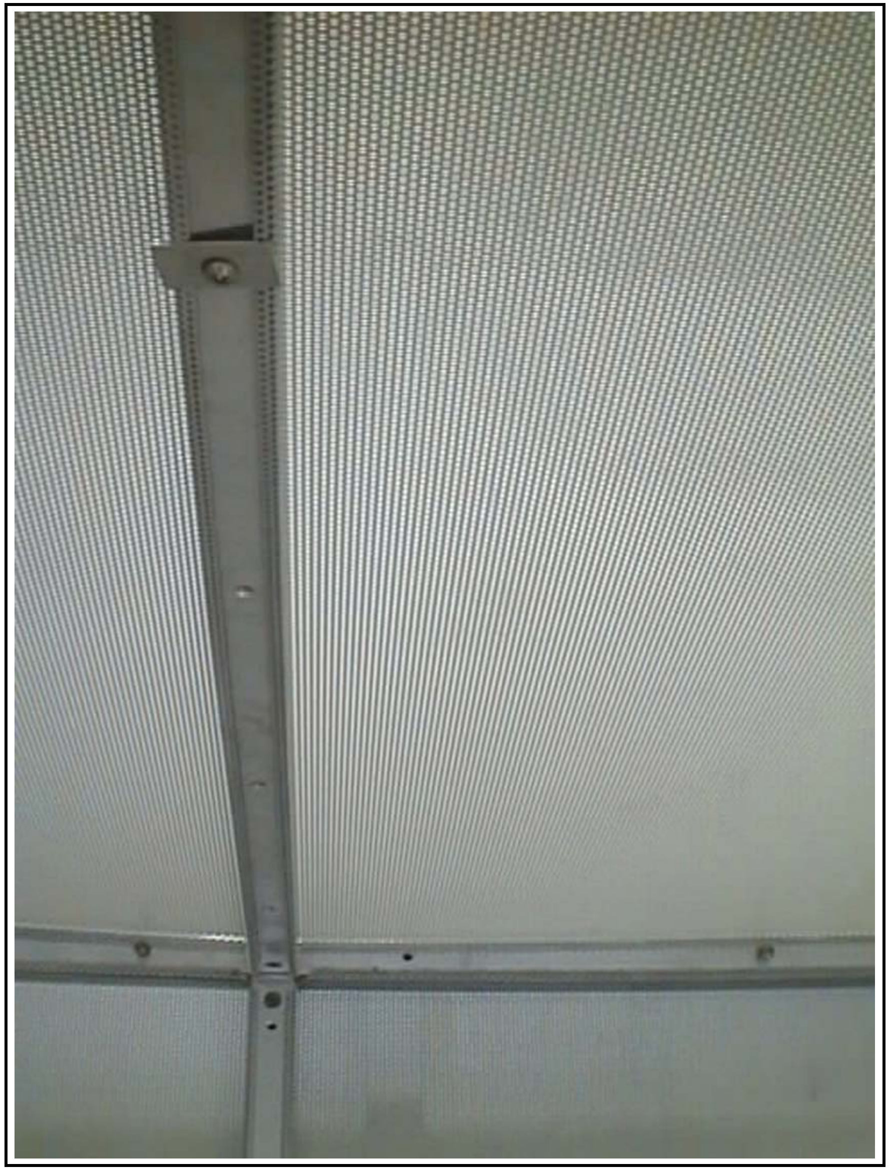


Fig. 47: Ceiling Panel Assembling



Fixing The Joint Covers And Floor Wooden Panels

At completion of the panel installation, fix them to the supporting structure with the joint covers.

The above mentioned joints have been divided and classified as ceiling, side wall and floor joints.

Fix them in the following order:

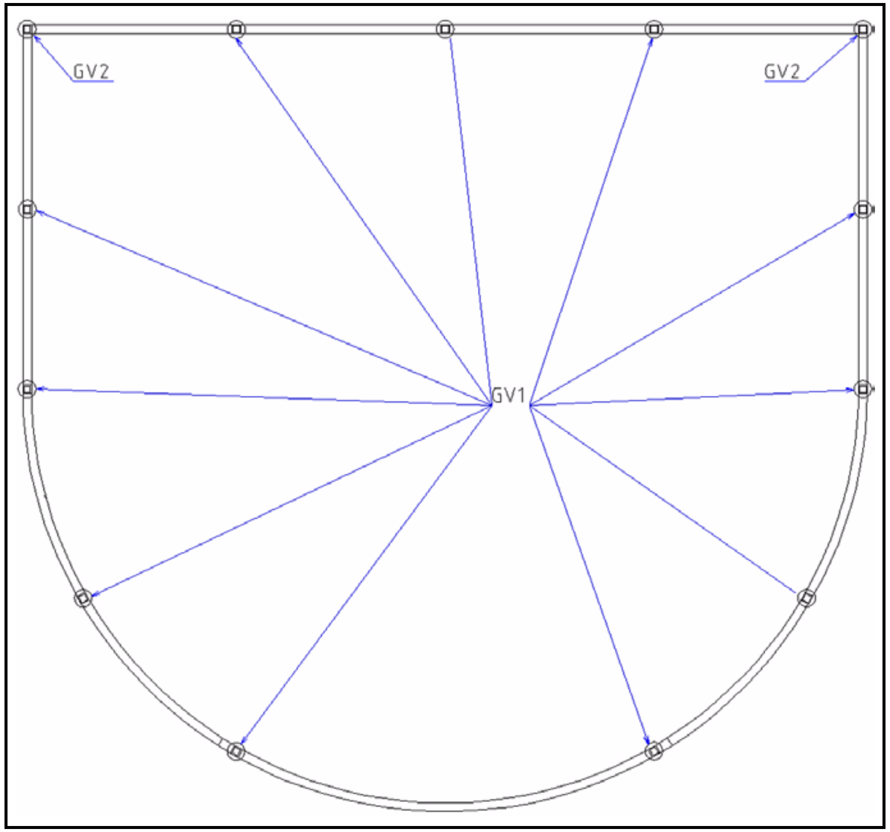
- Vertical joint covers
- Ceiling joint covers
- Floor perimeter joint covers
- Floor wooden panels
- Floor joint covers

Vertical joint covers

Proceed as follows:

- Remove the temporary anchoring pieces
- Insert the joint covers
- Insert and tight manually all the screws

Fig. 48: Vertical joint covers layout



WARNING **Mount the front Vertical Joint Covers only after the aluminium stripes with copper contacts are placed (left and right door opening sides)!!!**

Fig. 49: *Copper contacts*

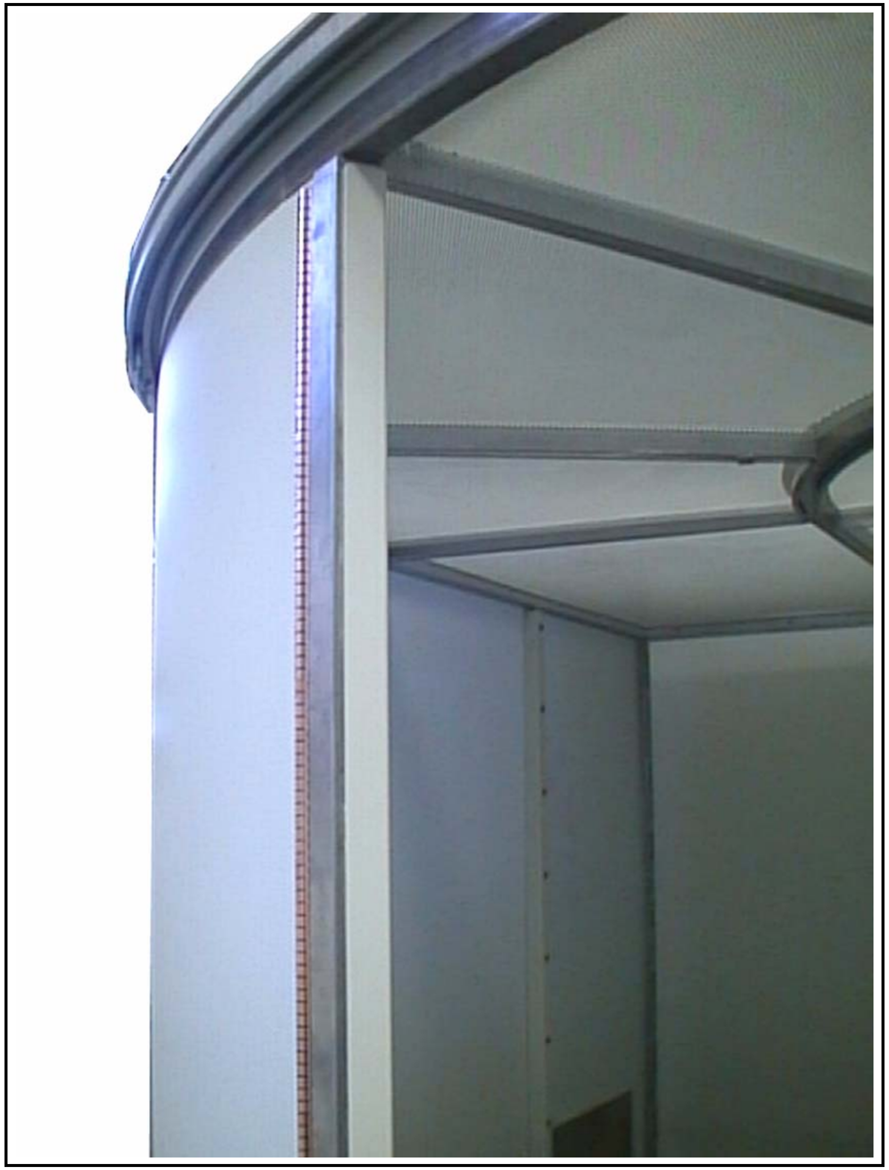
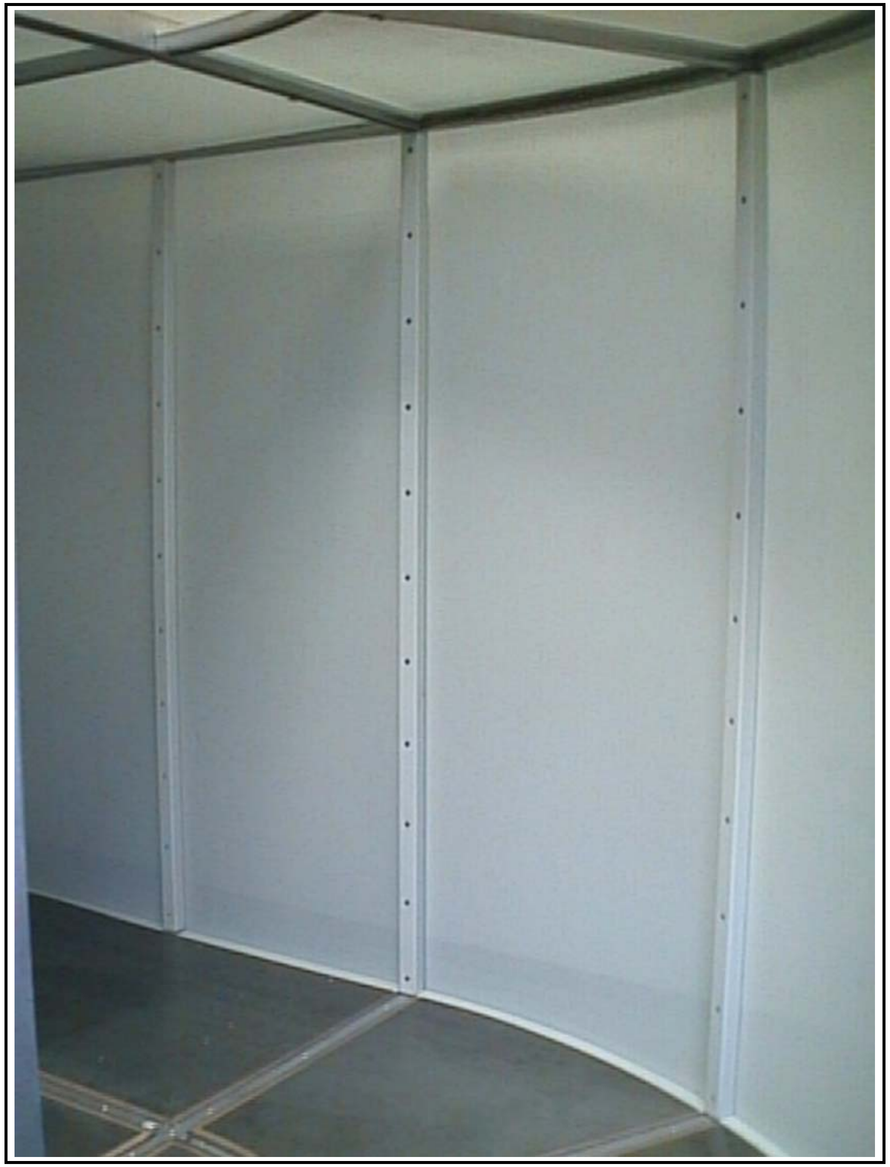


Fig. 50: *Vertical joint covers*



Ceiling joint covers

Follow the procedure indicated in the Side joints paragraph as well as the directions reported in the next figure.

Fig. 51: Ceiling joint covers Layout

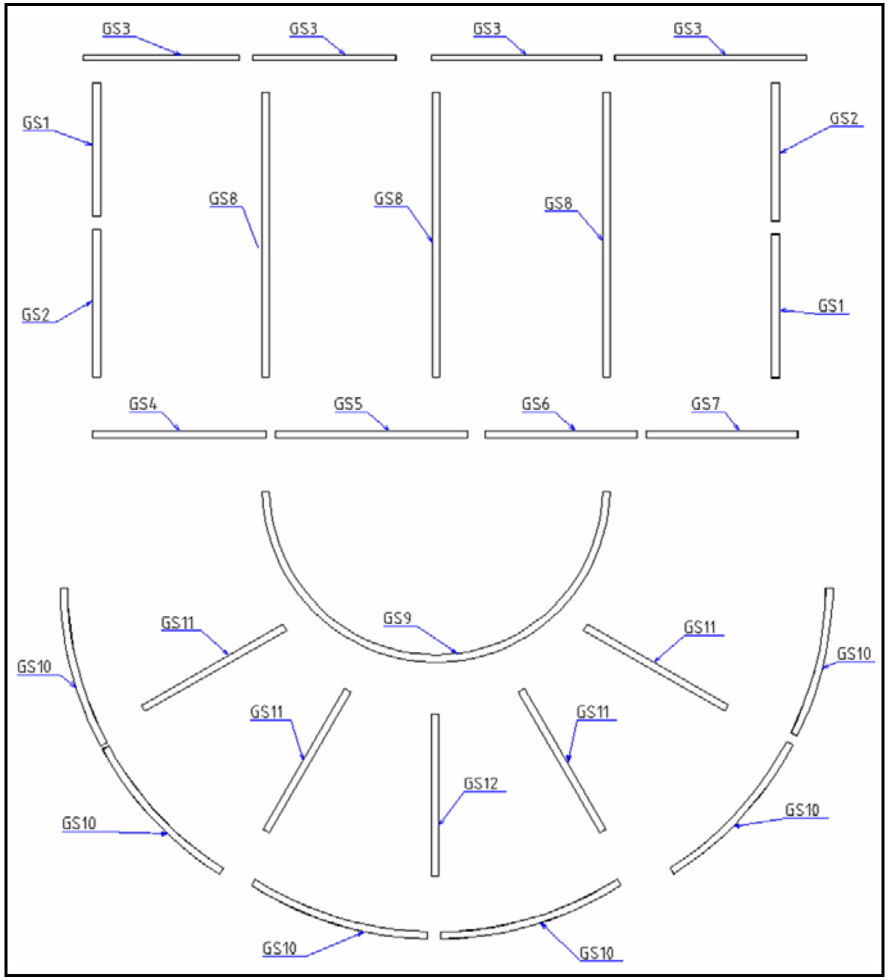
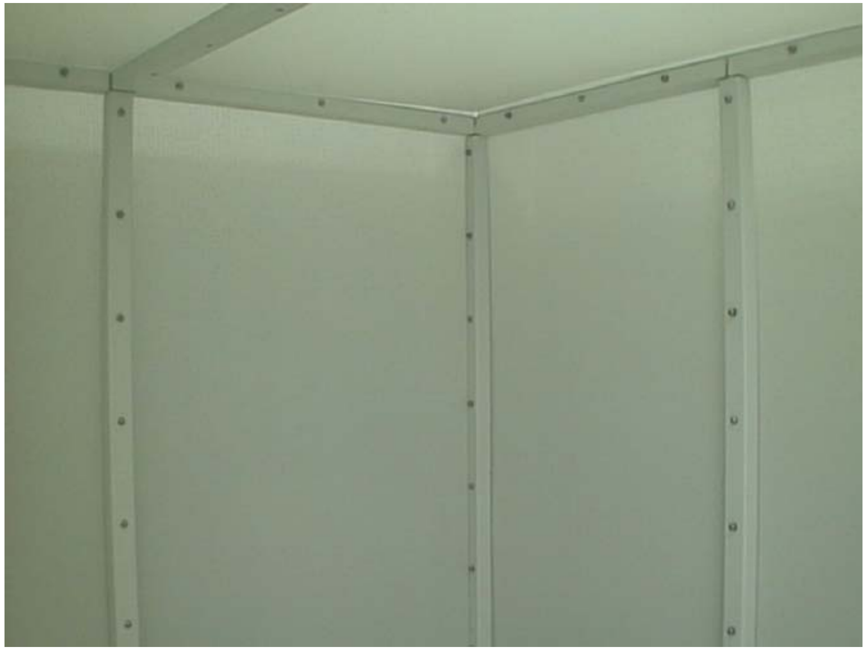


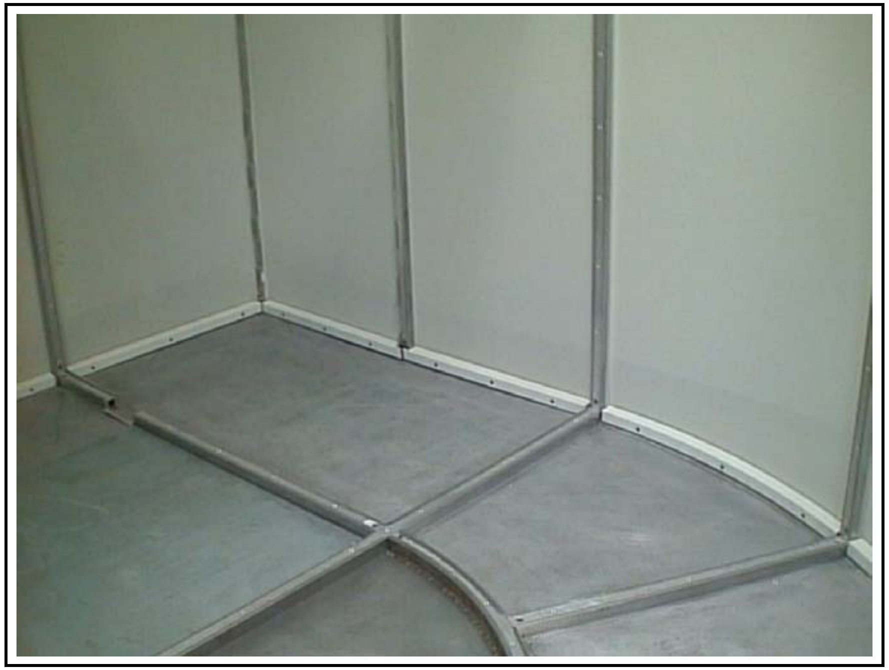
Fig. 52: Ceiling joint covers



Floor Perimeter Join Covers

These components must be installed before the wooden panels

Fig. 53: Floor Join Covers



Floor Wooden Panels

Fig. 54: Panel Layout for Left Raceway

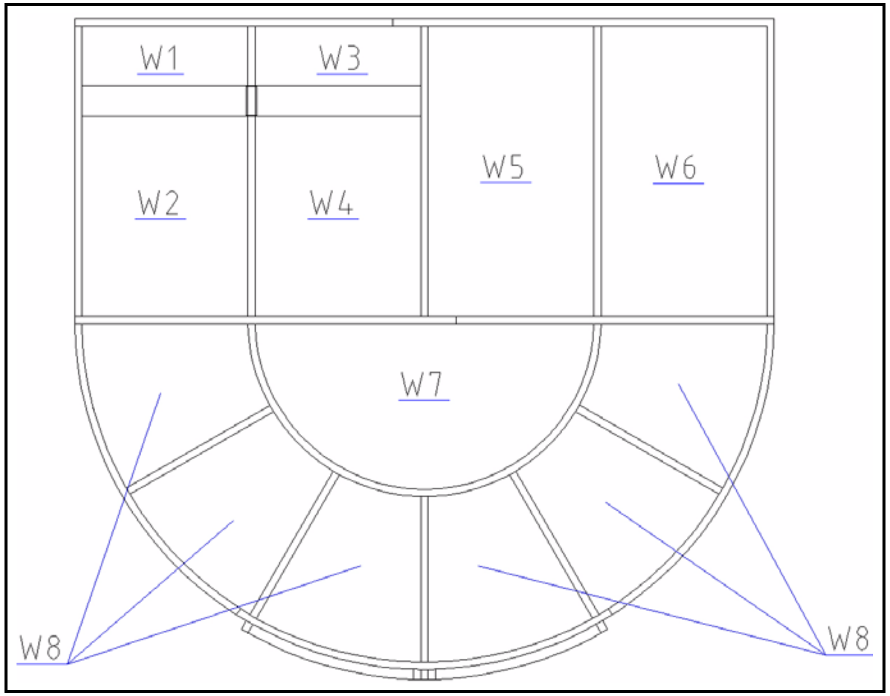


Fig. 55: Panel Layout for Right Raceway

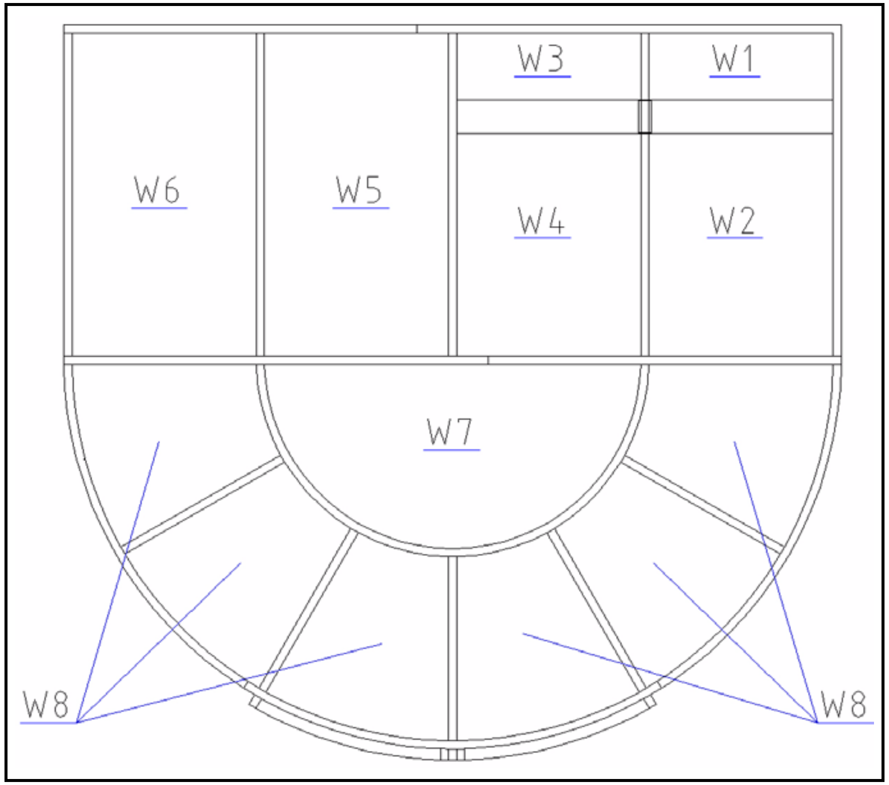


Fig. 56: Panel Assembling

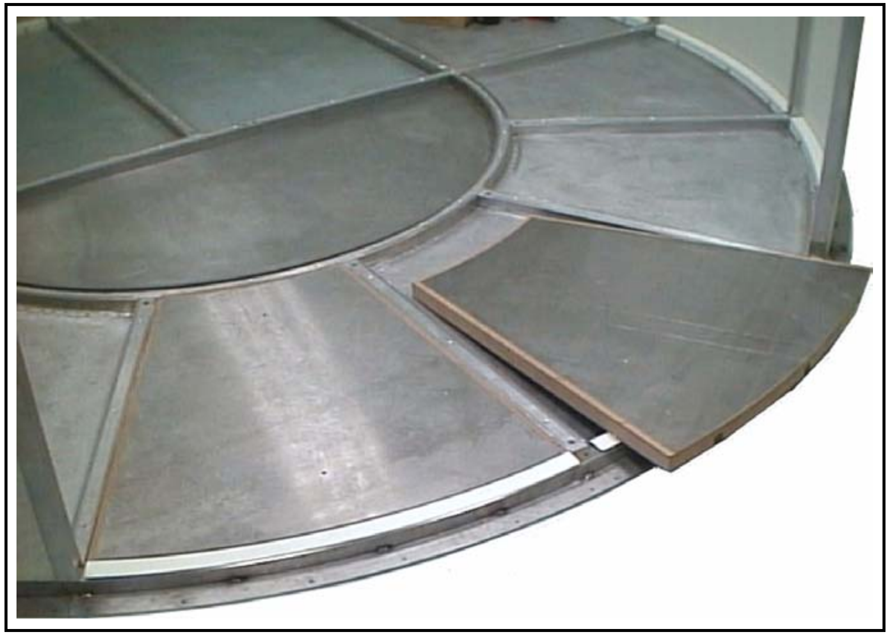


Fig. 57: Panel Assembling for left raceway

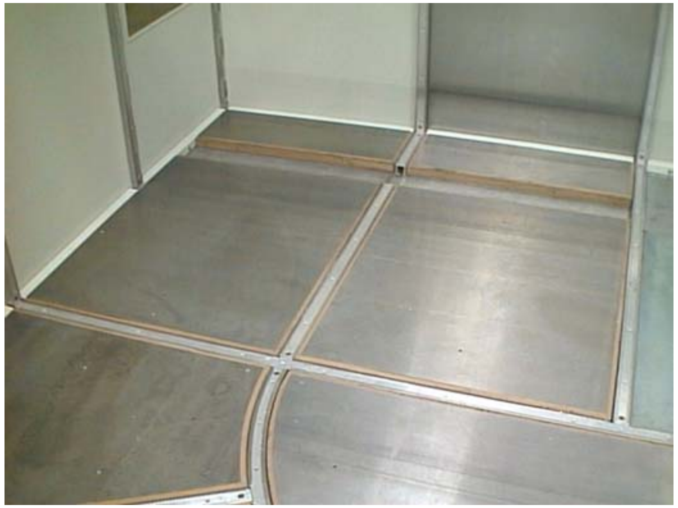
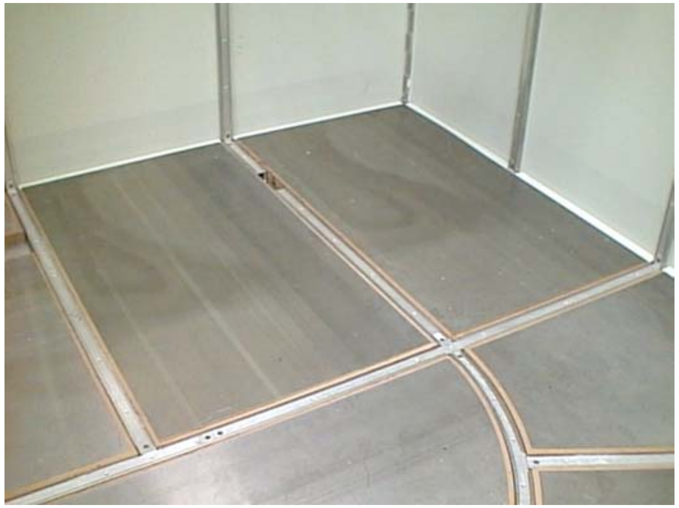


Fig. 58: Panel Assembling for left raceway



Floor joint covers

The joints along the perimeter in the positions indicated in the next figure are already placed. Place the floor joint covers on the wooden panels ant tight all the screws with a 5 Nm moment.

Fig. 59: Floor joint covers assembling order for left raceway

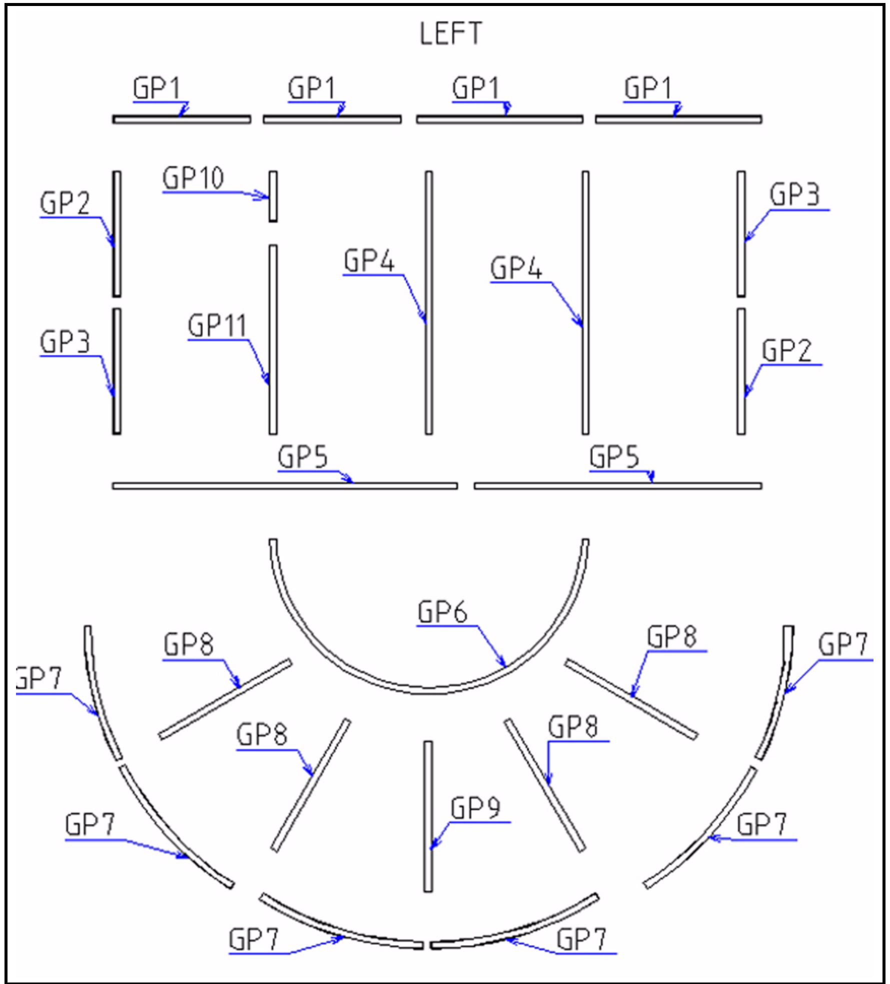


Fig. 60: Floor joint covers assembling for right raceway

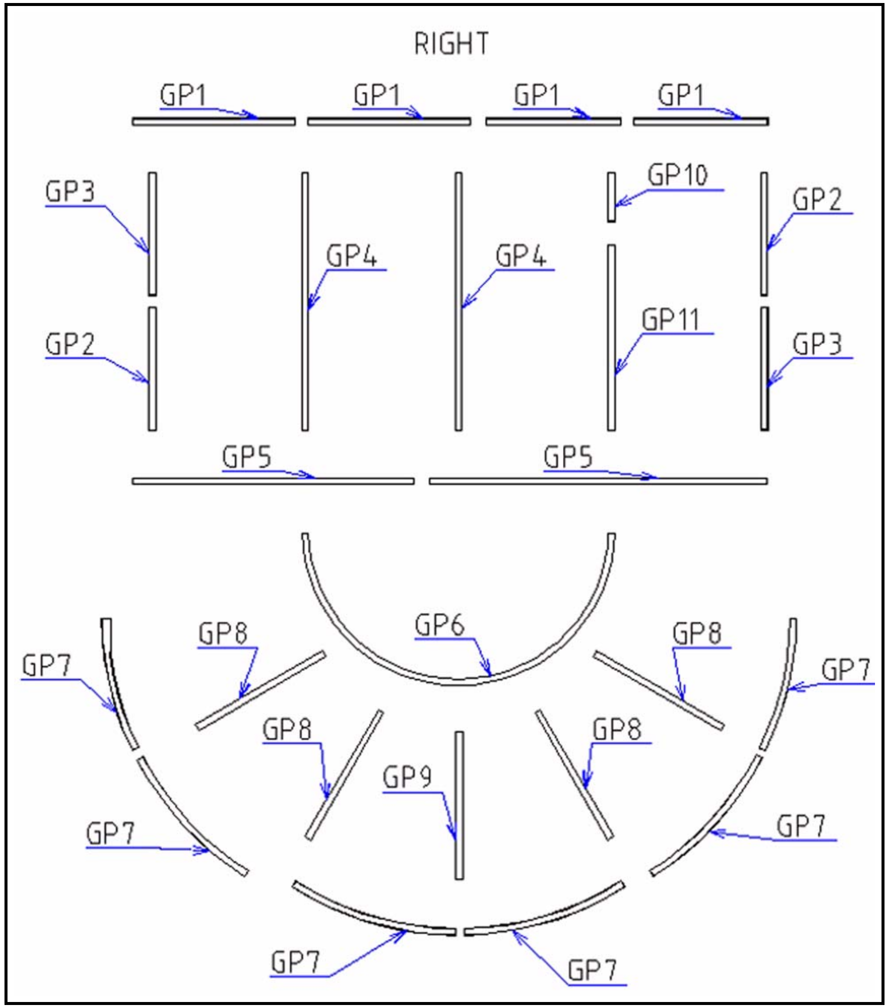
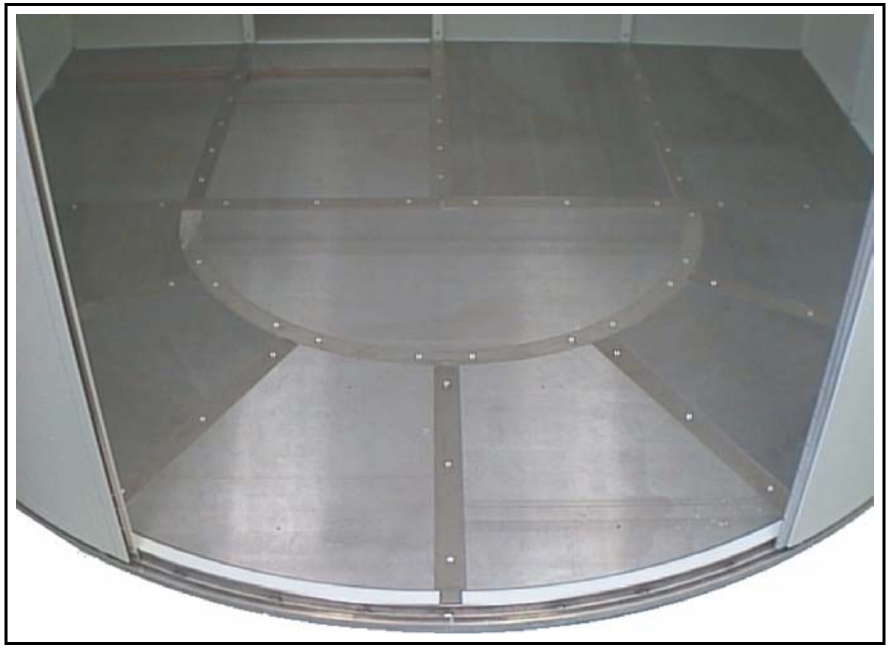


Fig. 61: Floor Joint Covers



When the curved wooden panels are placed fix the square aluminum piece in the center of the door opening (as shown in the previous figure).

Door Installation

Before to place the doors clean the internal upper and lower sides and horizontally place the copper finger stripes by 1 cm from the door edges (upper and lower).

Fig. 62: Central door configuration

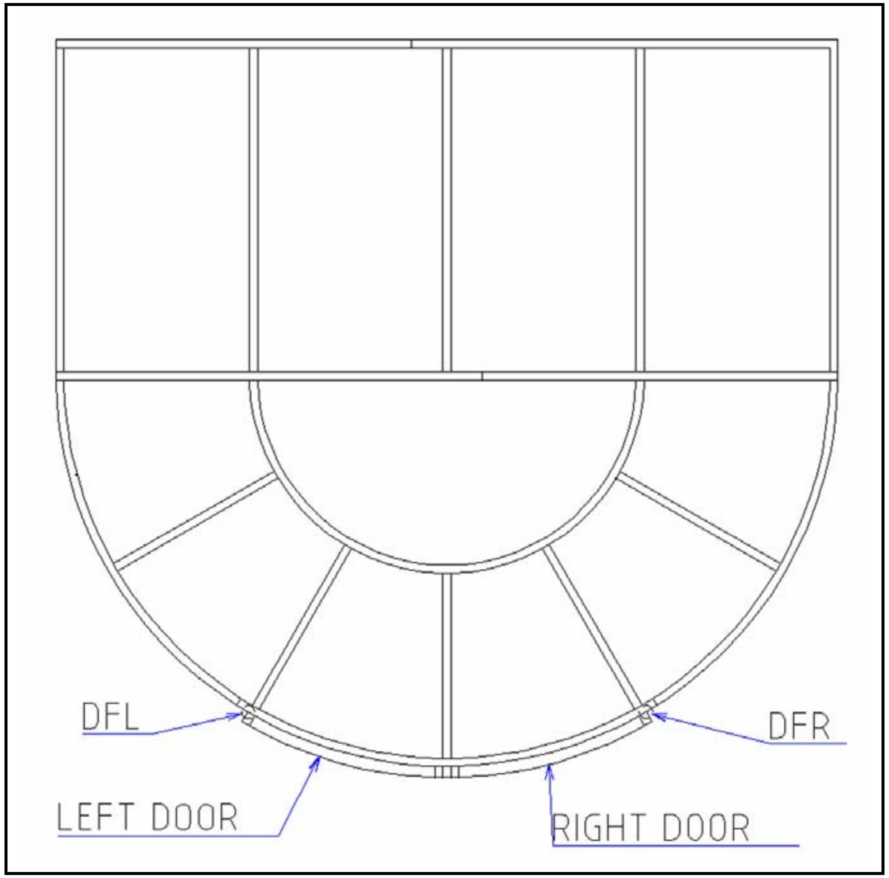


Fig. 63: Left door configuration

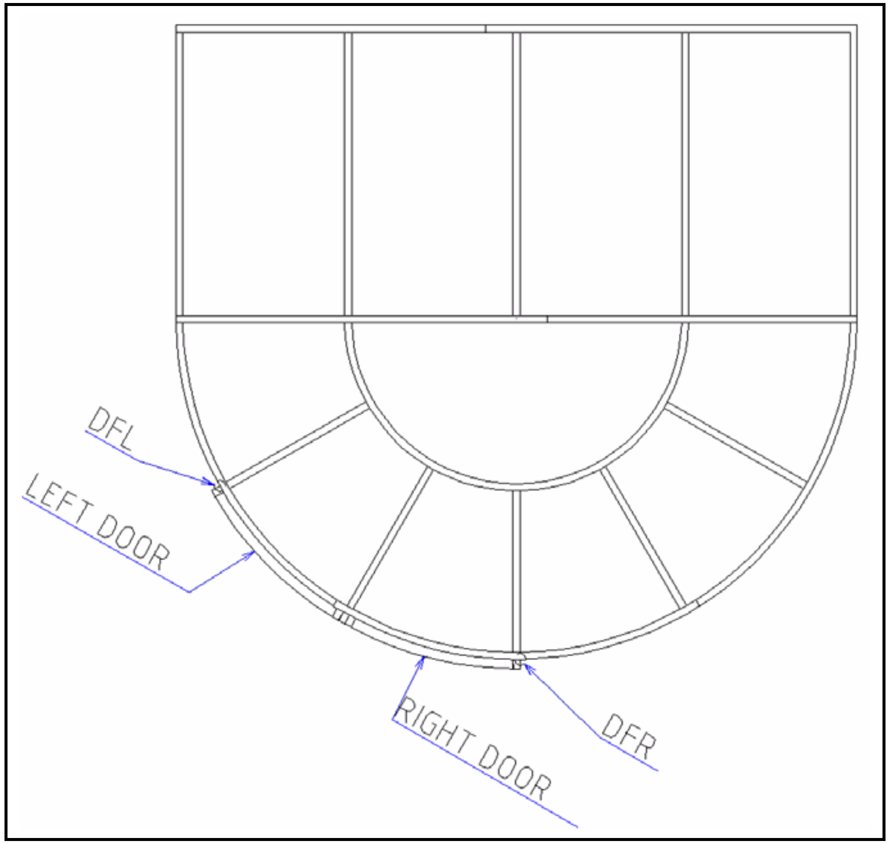
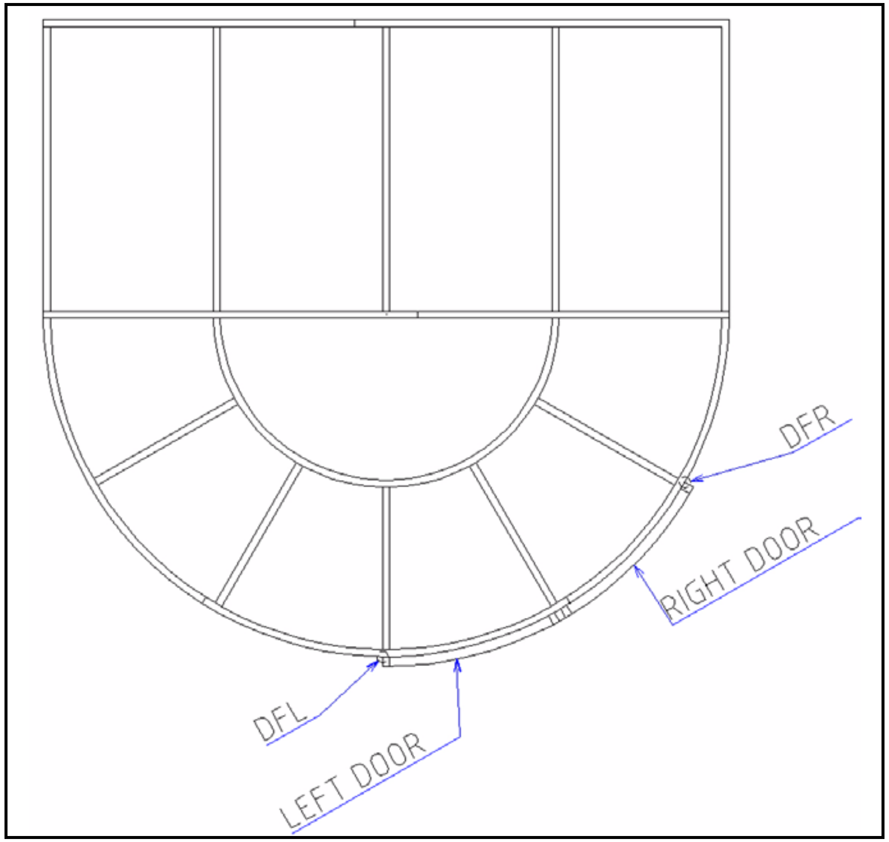


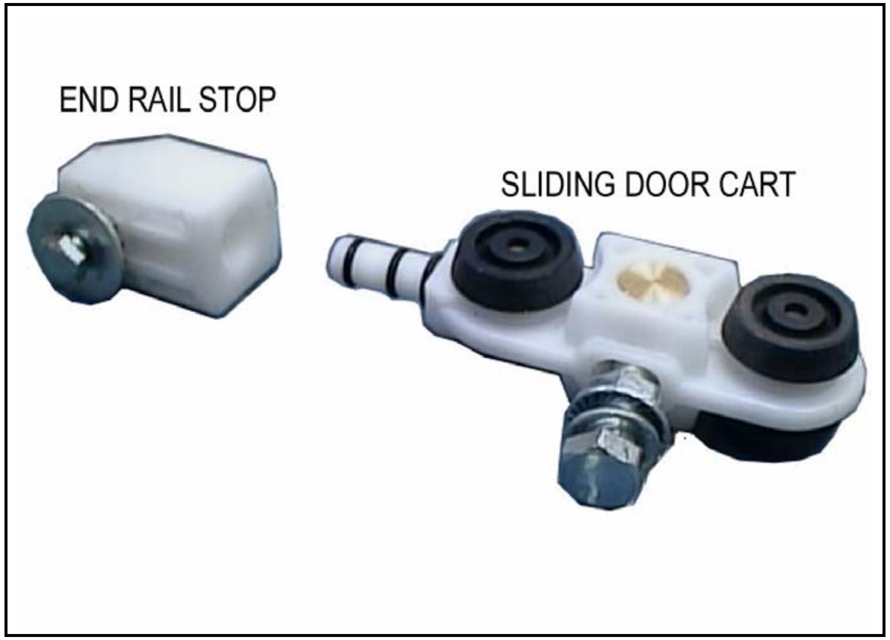
Fig. 64: Right door configuration



Every door has two sliding door carts and two end rail stops.

To correctly mount them follow this procedure:

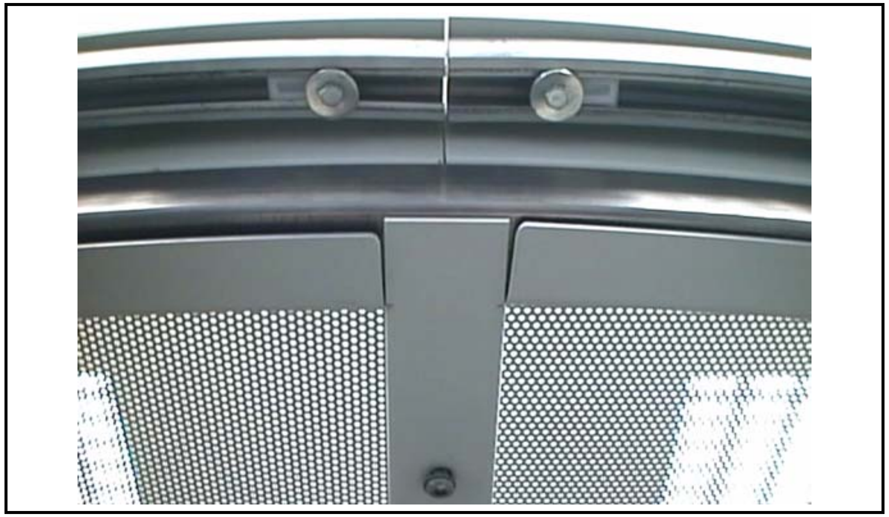
Fig. 65: Sliding cart and stop



⚠**WARNING** **Place the end rail stops and the sliding door carts taking care that they must fit when the doors are completely opened or closed!!!**

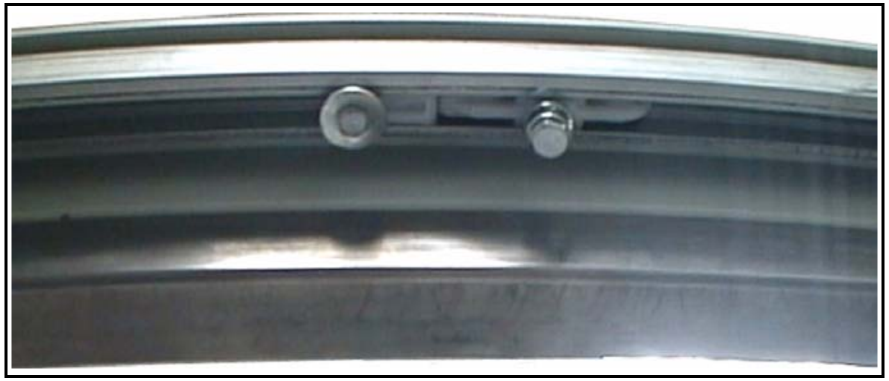
- Slide into the upper rail two end rail stops and fix them in the pavilion rail central position without tight their bolts

Fig. 66: Central Stop Positions



- Slide into the upper rail two sliding door carts for every door (left and right) without tight their bolts then place the end rail stops at the end of the rail (left and right)

Fig. 67: Lateral sliding cart and rail stop



⚠**WARNING** **Don't place the lateral end rail stops too close to the end of the rail to avoid finger crushing opening the doors from inside the Pavilion!!!**

- Move the left door close to the upper rail, join the left sliding door carts in the special parts present on the door upper edge and tight their bolts then do the same with the right door

Fig. 68: Join the door to the sliding carts

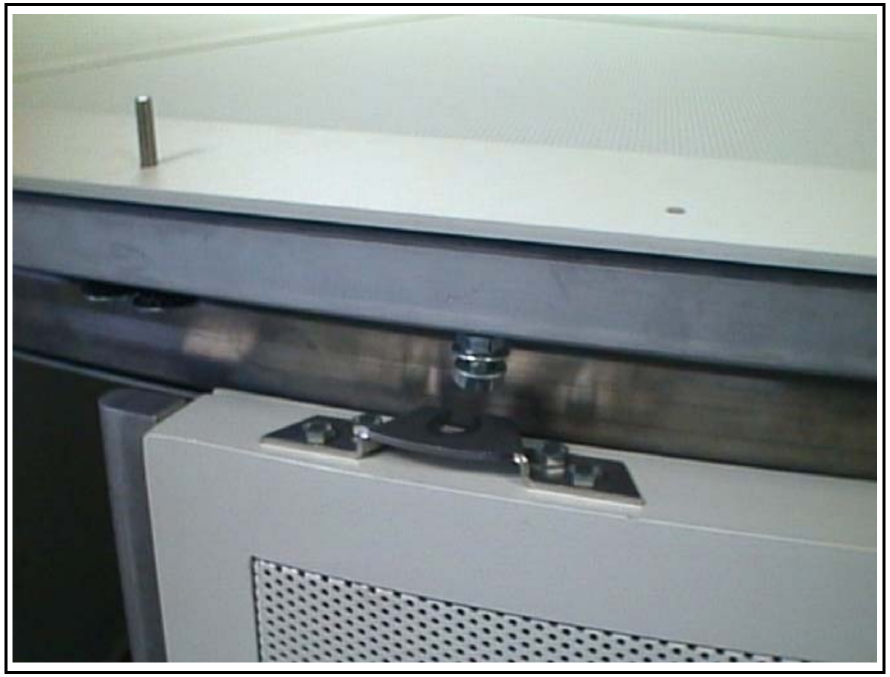
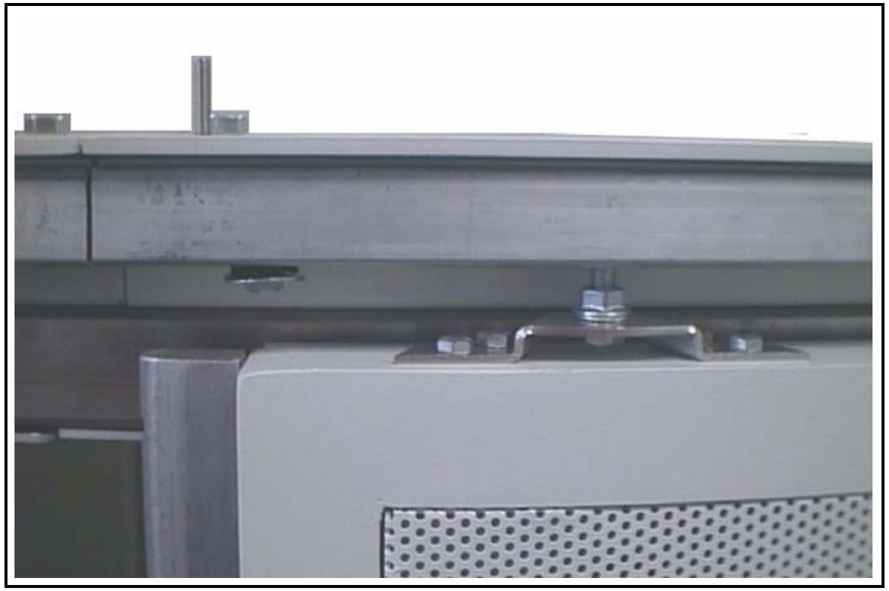


Fig. 69: Door joined to the sliding carts



- Insert the lower rails sliding them under the doors and join the lower door wheels, then fix the rails to the Pavilion metallic profile

Fig. 70: Left lower rail

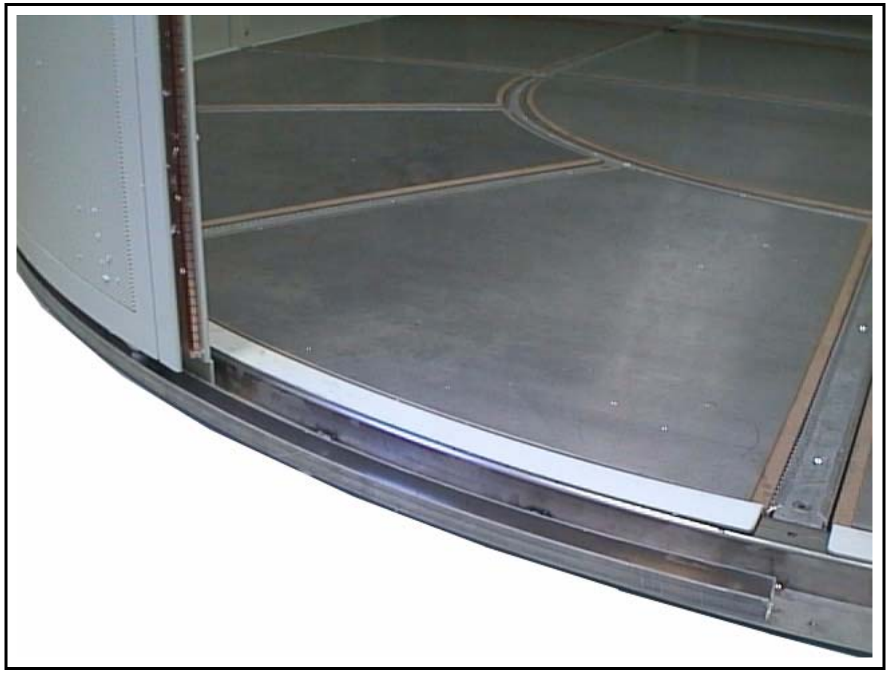
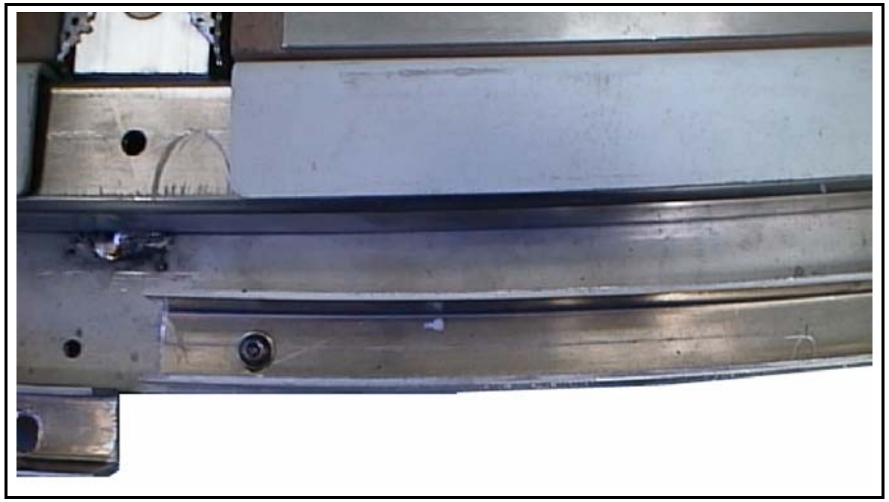
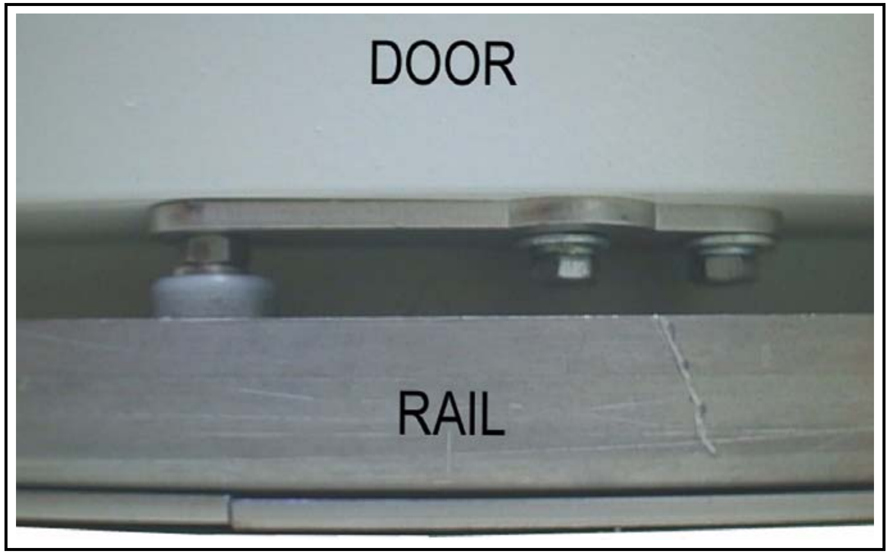


Fig. 71: Top view of the right lower rail



- Tighten the end rail stops bolts
- Close the doors and check if they are exactly in the middle of the opening, if it's so tight the end rail stop bolts otherwise move the central end rail stops
- Close the doors and check if in this position they are parallel otherwise set their heights acting on the upper bolts of the sliding carts
- Go inside the Pavilion, close the doors and check if the door lower copper fingers have a good contact with the Pavilion structure otherwise act on the lower parts of the door to move it: loose the bolts and move the door then tight back the bolts

Fig. 72: Lower door sliding mechanism



- Go inside the Pavilion, close the doors and check if the door upper copper fingers have a good contact with the Pavilion structure otherwise act on the upper door bolts parts of the door to move it: loose the bolts and move the door then tight back the bolts
- Mount the door carters on the screws present on the Pavilion upper side

Fig. 73: *Upper central screws*

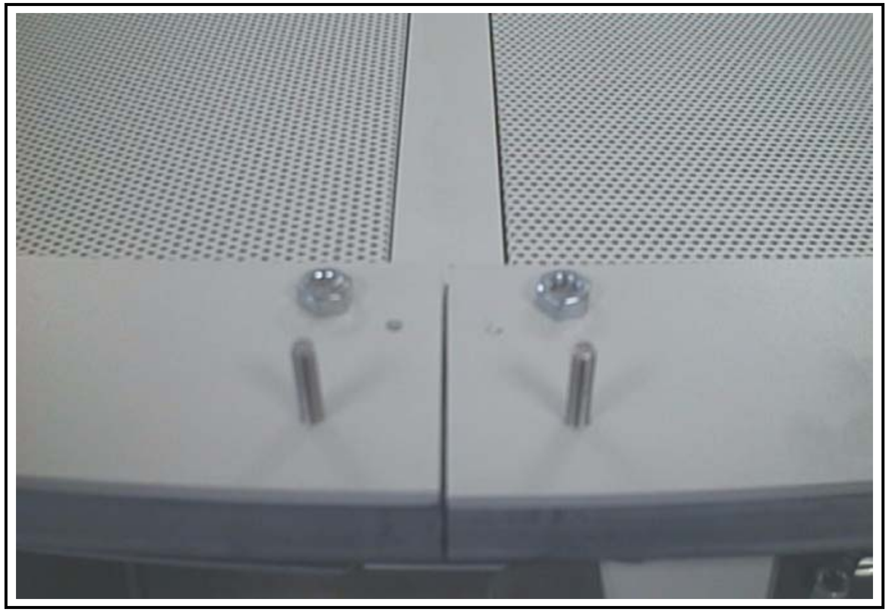
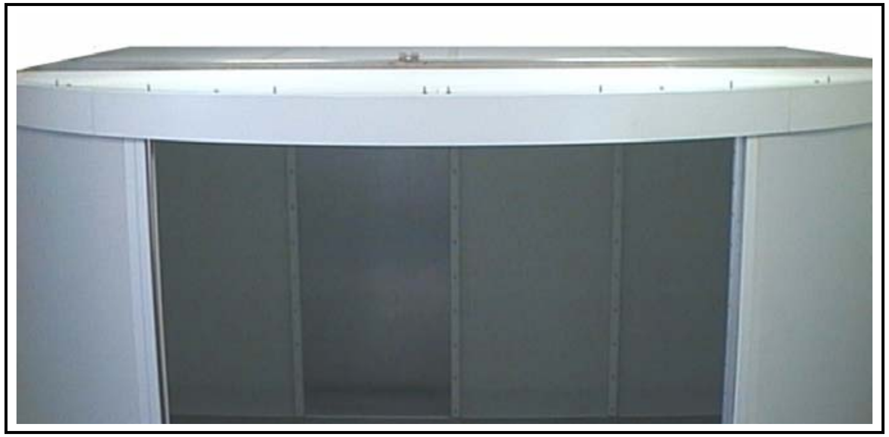


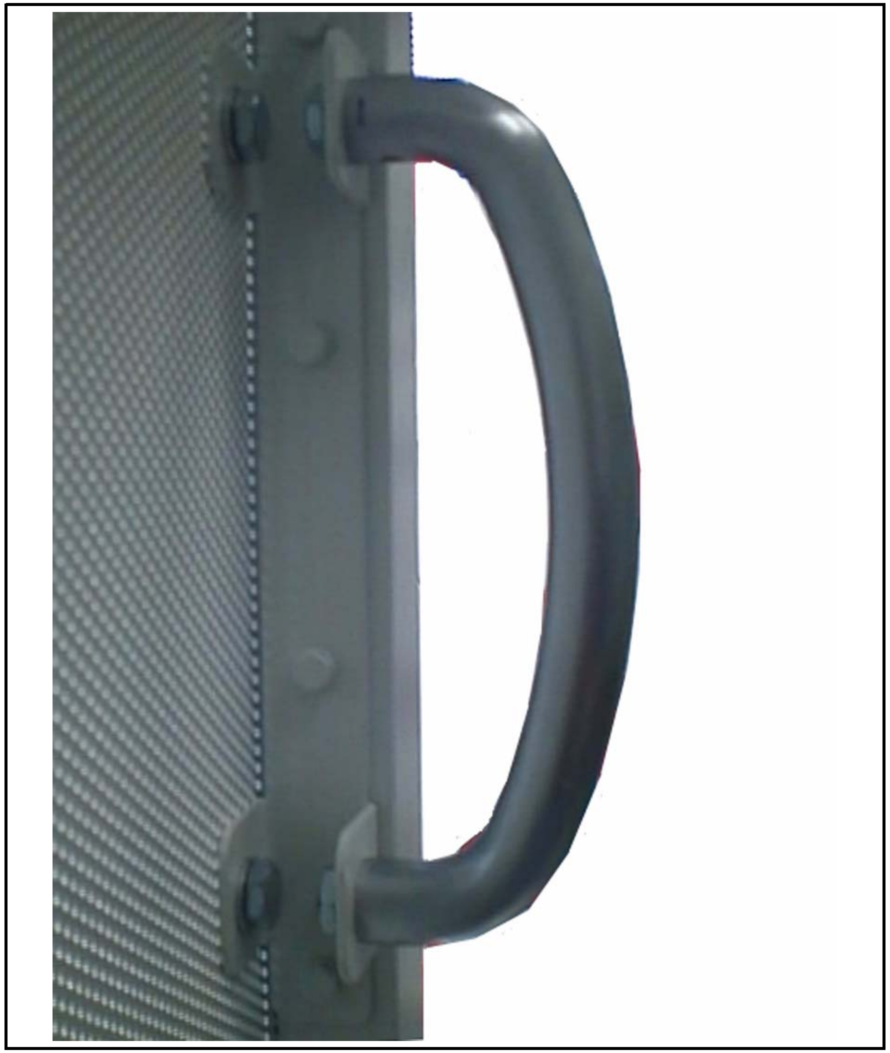
Fig. 74: *Carters correctly mounted*



Handles installation

Fix two handles for every door as shown in the next figure.

Fig. 75: *Door handle*



Finishing the floor

The Pavilion floor is composed of self-supporting wooden supports covered with vinyl. The vinyl coat is provided with the Pavilion and it must be cut in according with the Pavilion dimensions.

NOTICE	Before moving the magnet into the Pavilion, fix the FV1 element. The remaining elements will be installed after magnet moving and setting up

NOTICE	The vinyl Pavilion floor must be installed and leveled by a craftsman.

Install the vinyl floor as follows:

- Place the FV1 element and cut it
- Cut the vinyl coat to correspond to the cable routing area using the provided covers as a reference
- Glue the FV1 but remember to don't glue the cable routing area as shown in the following figure
- Place and cut the FV2 and FV3 elements then glue them
- Finish the installation of the floor by mounting the inclined plane giving access to the Pavilion (A3 code) and the steel band (A23 code). To fix the A3 element unscrew the 2 lower tracks, insert the inclined plane connections under the track and then tight back the screws

⚠WARNING DO NOT USE THE A3 ELEMENT WHEN MOVING THE MAGNET INTO THE PAVILION!!!

Fig. 76: Vinyl floor

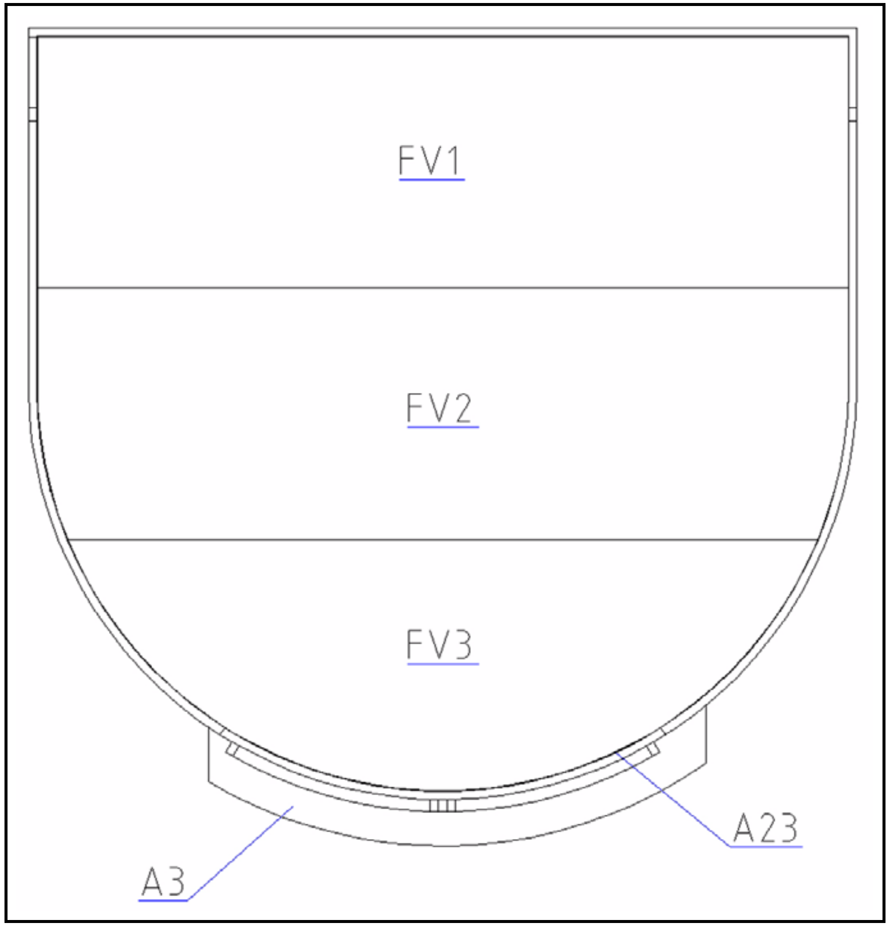


Fig. 77: Cable routing covers

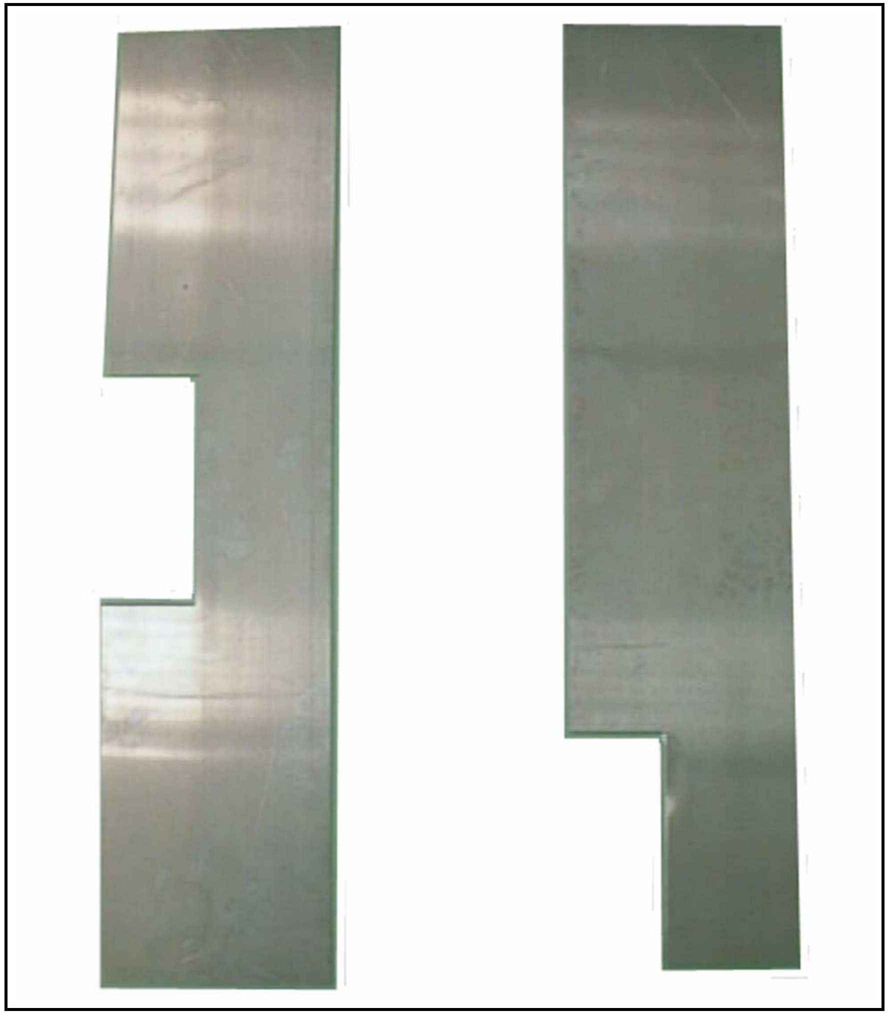


Fig. 78: Cable routing cover positions

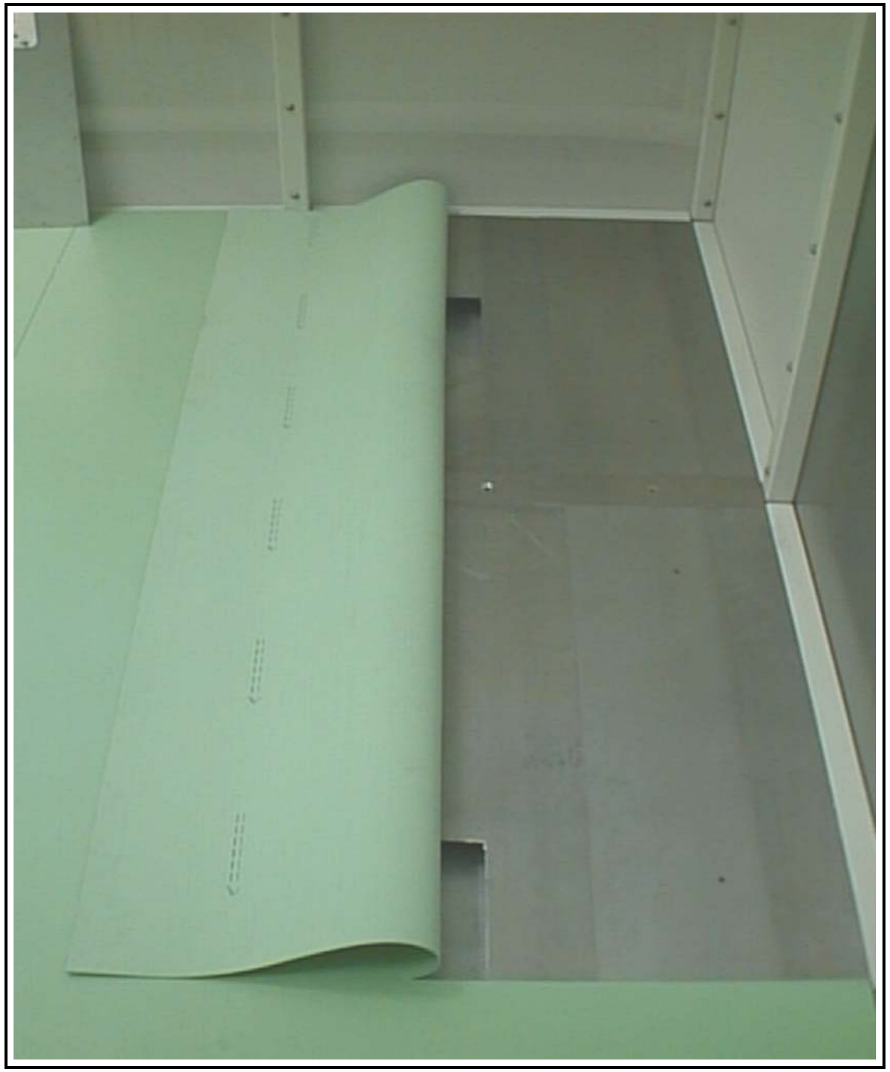


Fig. 79: Vinyl floor cuts for cable routing

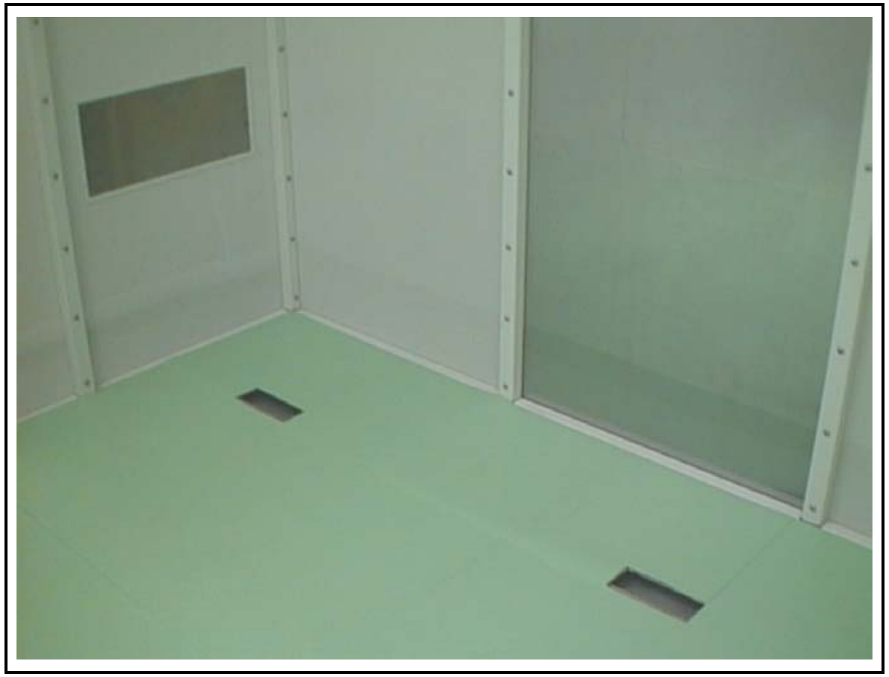
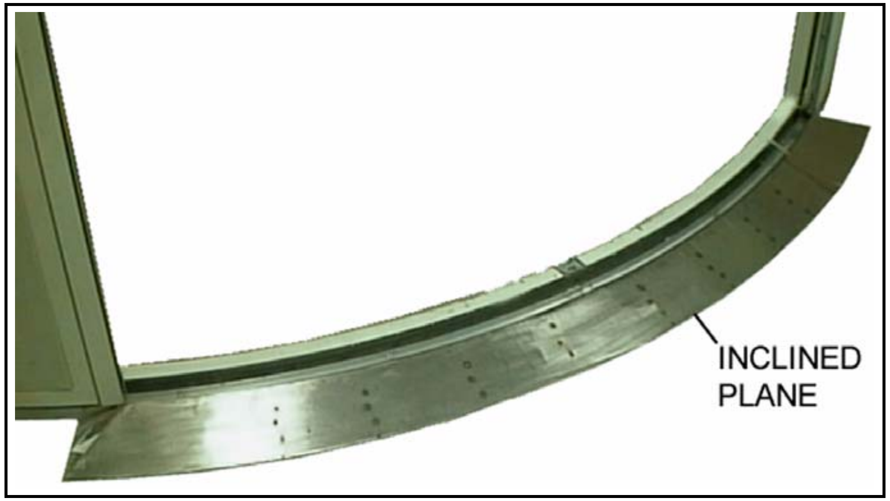


Fig. 80: Pavilion inclined plane



Grounding

Refer to Console installation paragraph.

Pavilion shielding Check

Perform this test using a couple of walkie-talkies adding one 20 dB attenuator to the receiver. Place one walkie-talkie inside the pavilion (door closed), one outside and try to transmit. If you are able to transmit check the pavilion integrity.

Painting

A painting kit is provided with the Pavilion. If necessary remove the paint with the potassium nitrate solvent.

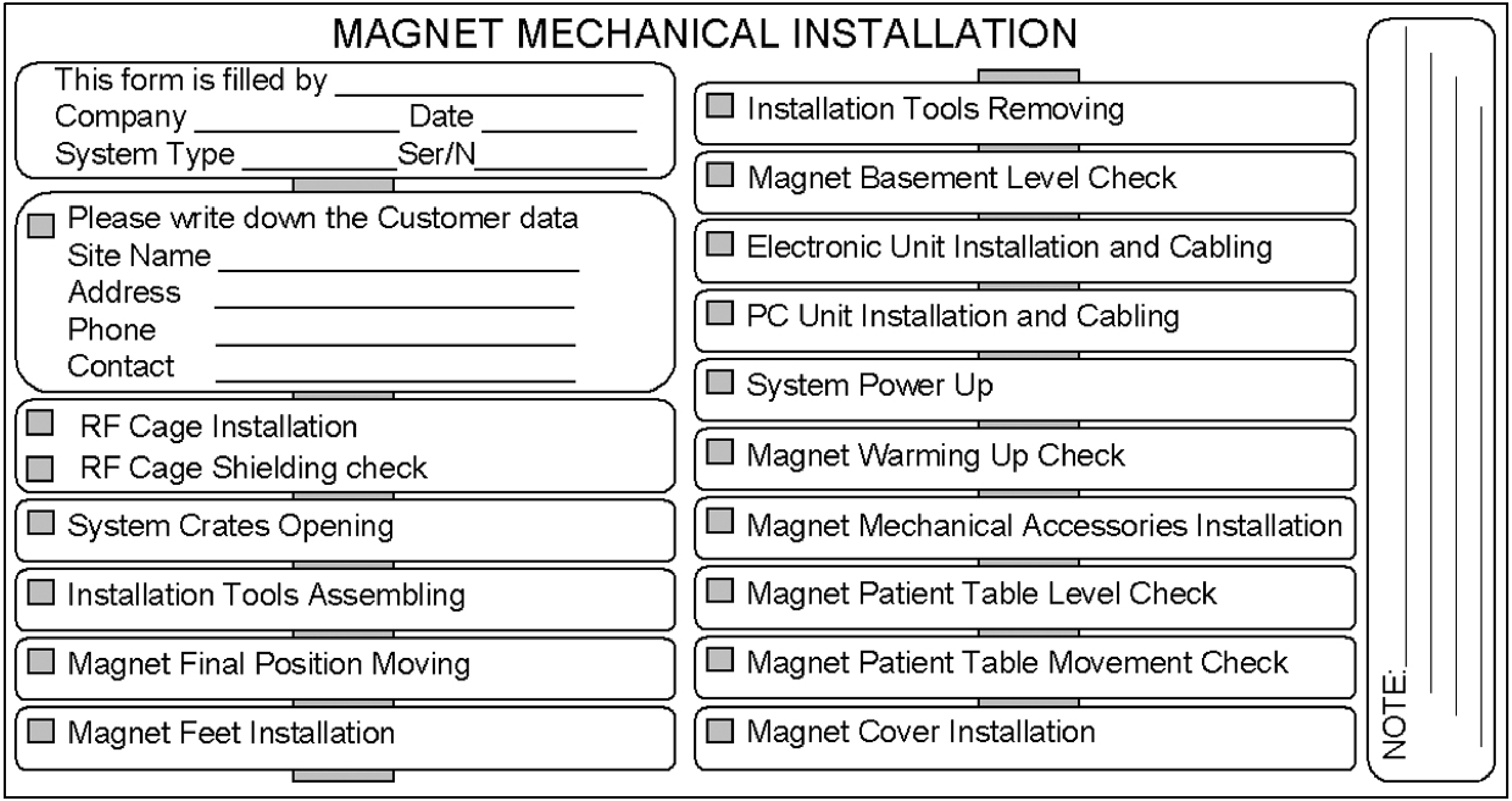
Warning/prohibitive signs

Refer to Location of warning/prohibitive signs paragraph.

System Installation

PLEASE COMPLETE THE FOLLOWING FORM MARKING OFF ALL THE PERFORMED ITEMS AND E-MAIL/FAX BACK TO ESAOTE.

Fig. 81: System installation flow chart



MAGNET MECHANICAL INSTALLATION

This form is filled by ____________

Company ____________ Date ____________

System Type ____________ Ser/N____________

☐ Please write down the Customer data

Site Name ____________

Address ____________

Phone ____________

Contact ____________

☐ RF Cage Installation

☐ RF Cage Shielding check

☐ System Crates Opening

☐ Installation Tools Assembling

☐ Magnet Final Position Moving

☐ Magnet Feet Installation

☐ Installation Tools Removing

☐ Magnet Basement Level Check

☐ Electronic Unit Installation and Cabling

☐ PC Unit Installation and Cabling

☐ System Power Up

☐ Magnet Warming Up Check

☐ Magnet Mechanical Accessories Installation

☐ Magnet Patient Table Level Check

☐ Magnet Patient Table Movement Check

☐ Magnet Cover Installation

NOTE:

Unit storage and transport

The four following crates are provided for transporting the units:

- Magnet crate
- Console crate
- Crate containing the patient positioning bed, monitor and other accessories
- Covers crate

Labels on the magnet crate give all the transport and storage specifications.

The bottom part of each crate is specially designed to make it easy to transport.

The magnet crate must only be lifted on the side indicated by the appropriate label.

The following table shows the features and contents of the magnet crates.

⚠**WARNING** **DO NOT TILT THE MAGNET CRATE MORE THAN 10 DEGREES DURING TRANSPORT**

Crate dimensions

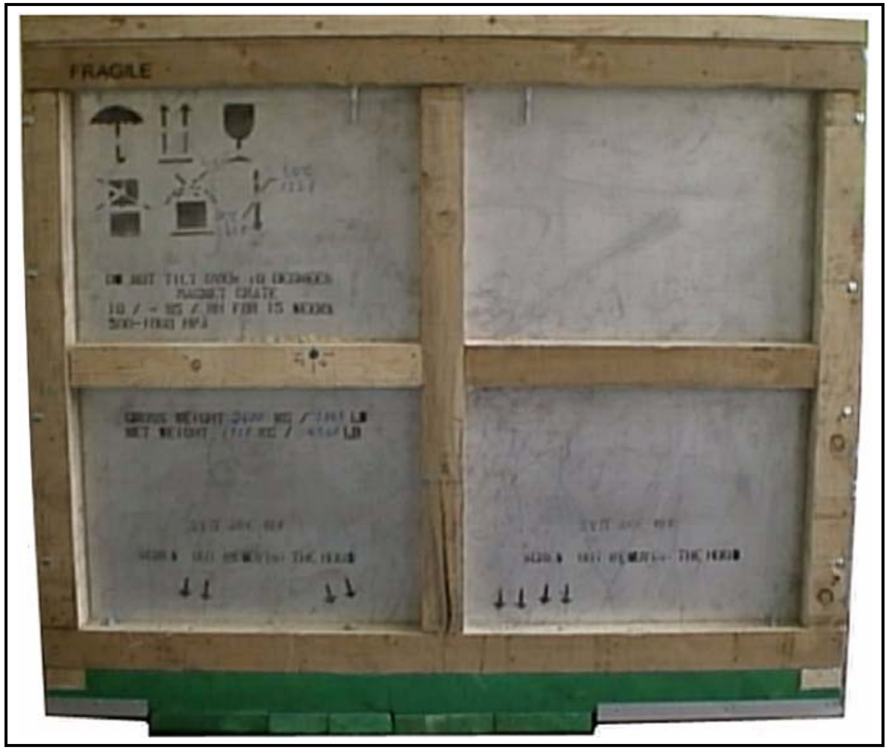
Tab. 3: Crates dimensions

Content	**Crate weight**	**Content weight**	**Size (L x W x H)**
Magnet unit	570 kg	1960 kg	171 x 186 x 182 cm
Covers	127 kg	60 kg	140 x 90 x 185 cm
Console	110 kg	130 kg	126 x 92 x 216 cm
Bed & Monitor	95 kg	128 kg	147 x 76 x 125 cm

CAUTION **DURING TRANSPORTATION AND STORAGE OF THE SYSTEM UNIT, THE FOLLOWING AMBIENT REQUIREMENTS MUST BE MET: TEMPERATURE MUST RANGE FROM -5 and 50 °C. PRESSURE MUST RANGE FROM 500 and 1060 hPa FOR 15 WEEKS. RELATIVE HUMIDITY MUST RANGE FROM 10% AND 95% RH FOR UP TO 15 WEEKS**

NOTICE IF SEVERAL UNITS ARE BEING TRANSPORTED, DO NOT PLACE THE CRATES CONTAINING THE MAGNETIC UNIT AT A DISTANCE OF LESS THAN 3 METER (9 FEET) FROM ONE ANOTHER. DO NOT PLACE THE CRATES ANY CLOSER TO BIG IRON MASSES. DO NOT TURN THE CRATES OVER. DO NOT STACK MAGNET UNIT CRATES ONE ON TOP OF THE OTHER DURING TRANSPORTATION.

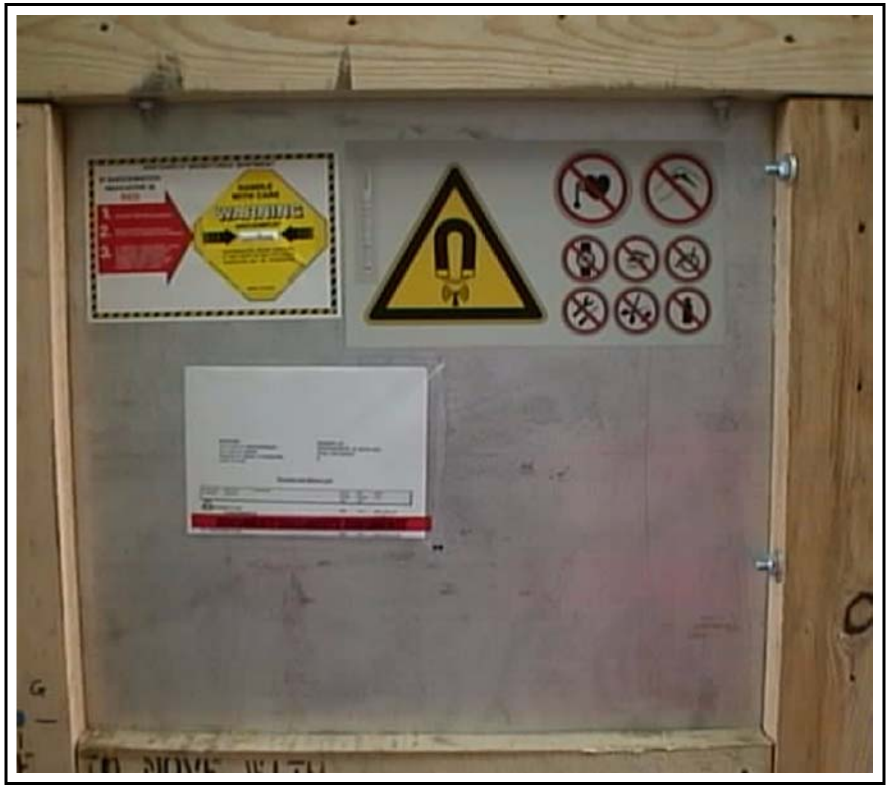
Fig. 82: *Magnet crate*



NOTICE

THE SHOCK DETECTORS (SPEC.: 25 "g" x 50 ms) FITTED ON THE CRATES CHECK WHETHER TRANSPORTATION AND STORAGE REQUIREMENTS ARE DULY MET

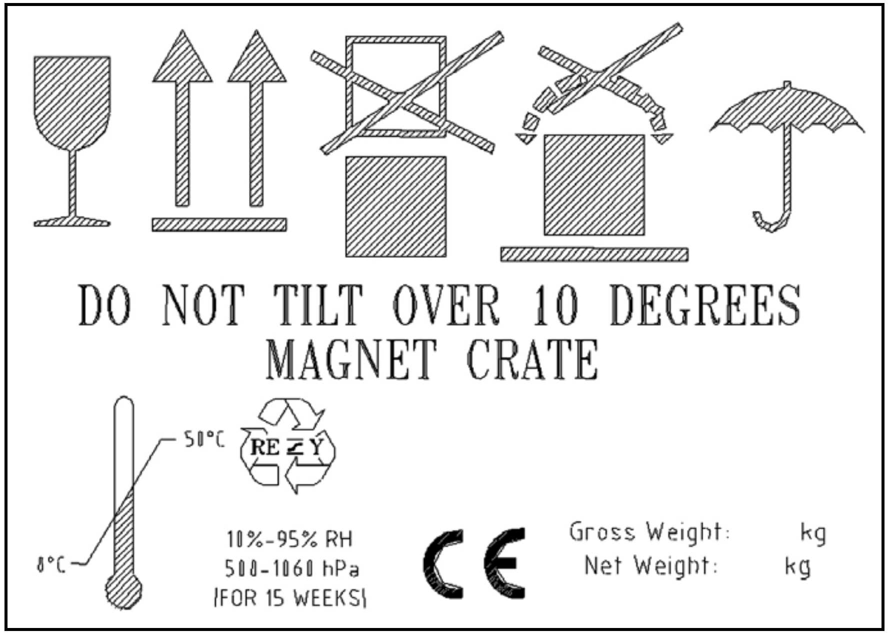
Fig. 83: *Shock detector, label and invoice documents*



NOTICE

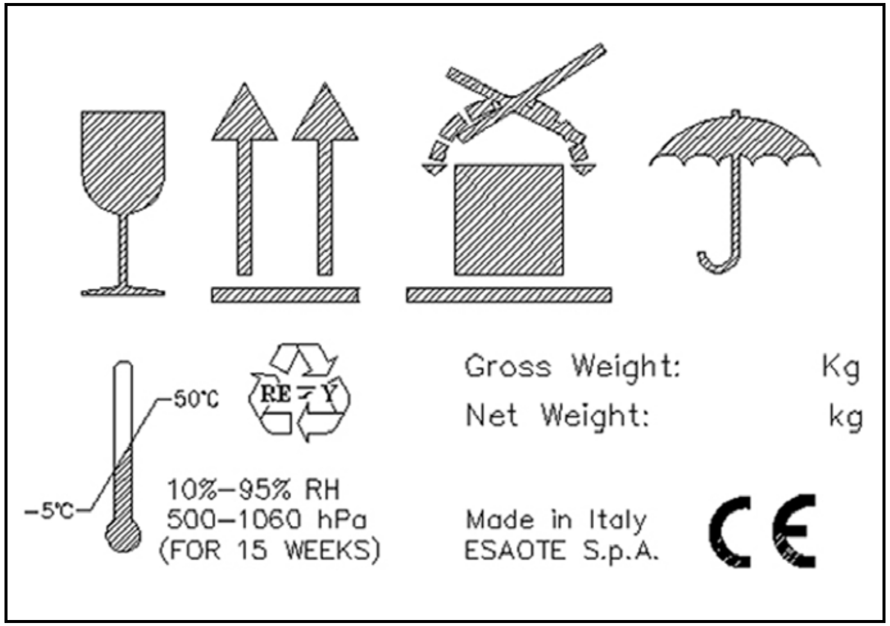
IF ONE OF THE SHOCK DETECTORS IS RED OR IF THE CRATES ARE CLEARLY DAMAGED INFORM THE SERVICE DEPARTMENT AND THE INSURANCE COMPANY BEFORE PROCEEDING WITH THE INSTALLATION

Fig. 84: The label indicates on what side the crate can be lifted



NOTICE BE EXTREMELY CAREFUL WITH THE CRATE CONTAINING THE MAGNETIC UNIT BOTH DURING STORAGE AND TRANSPORTATION BECAUSE OF THE FRINGE FIELD THAT IS ALSO PRESENT OUTSIDE THE CRATE

Fig. 85: Crate console or accessories crate



NOTICE THE SIZE AND THE GROSS WEIGHT OF THE OTHER CRATES CONTAINING THE CONSOLE UNIT, PATIENT POSITIONING BED, BED COVERS, MONITOR, COILS AND ACCESSORIES WILL DEPEND ON THE MEANS OF TRANSPORT CHOSEN (BY AIR, BY SEA, BY ROAD…), AND THE NUMBER OF UNITS

Recycling

If possible, the crates and the metal support of the magnetic unit, used for transportation, should be recycled a maximum of 10 times.

Unit installation

Installation tools

- Screwdrivers:
  – Phillips tips
  – Standard tips
- Electric screwdriver
- Power drill
- Spanners:
  – 17, 19 and 46 mm
- Allen wrenches
  – From 2 to 10 mm
- Adjustable spanners:
  – From 13 to 19 mm
- Spirit level
- Multi-meter
- Non magnetic tools set

⚠**WARNING** **The electronic modules of the System are internally and continuously powered with 220 V AC supplies. Never change any internal SET-UPS power supply**

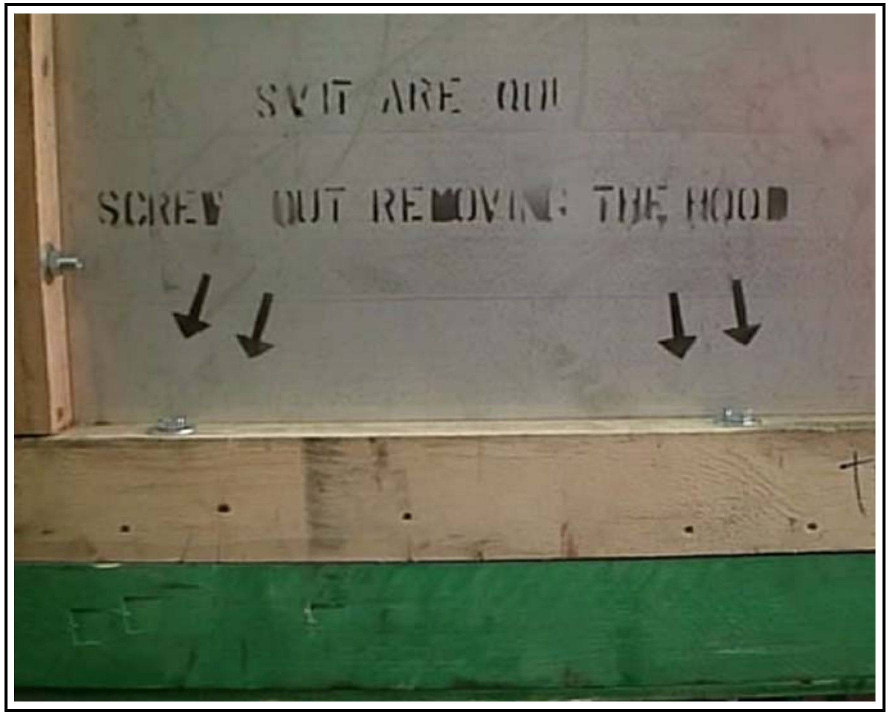
Mechanical installation procedure

How to open the magnet crate

The magnet crate should be opened outside the System room, in this case you can lift the magnet crate roof and sides. Otherwise you must open all the sides of the crate.

To lift the crate roof, remove the sixteen screws along the lower edge of the crate (four per side), take out the two sliding panels (front and rear pallet sides) and pull up the top side of the crate.

Fig. 86: Arrows painted on the crate indicate where the screws are



Use the four hooks shown in the next figure to pull up the roof of the magnet crate.

To install the four hooks (two per side) choose one side and remove two bolts along the upper edge of the crate then insert the bolts with their heads on the bottom so you can screw the hooks onto them. Carry out the same operation on the opposite side.

Fig. 87: *Magnet crate hooks*

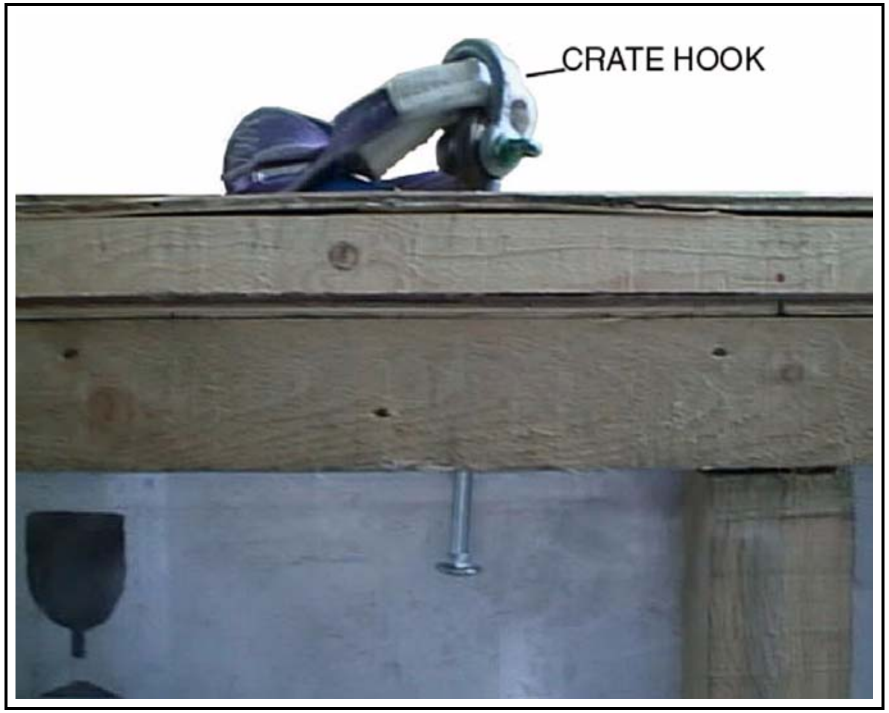
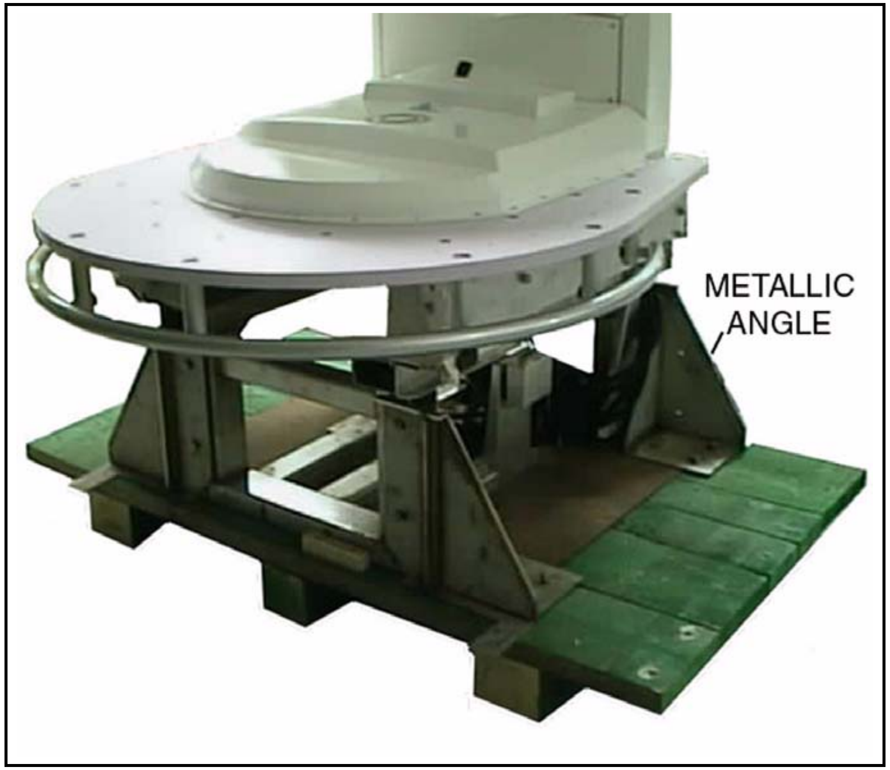


Fig. 88: Magnet and pallet with four metallic angle



Now remove the four metallic angles fixed on the pallet and on the magnet base. Every metallic angle has four screws: two on the pallet and two on the magnet base.

Metallic structures installation

Necessary tools: Magnet Installation Tool.

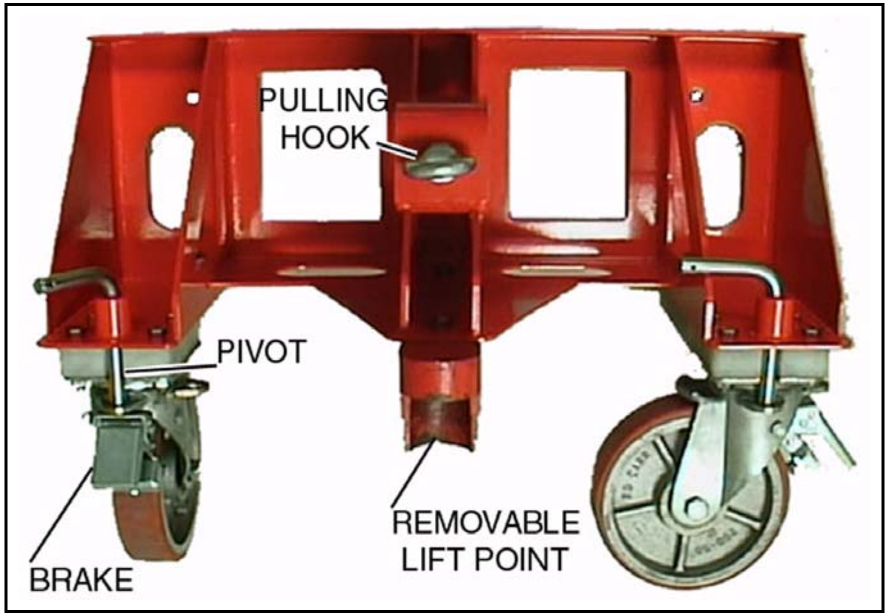
To remove the pallet, mount the two red metallic structures (shown in the following figure).

Four bolts per side are soldered on the magnet base. Use them to fix the metallic structures.

There is one front metallic structure and one rear: the distance between the installation holes is different.

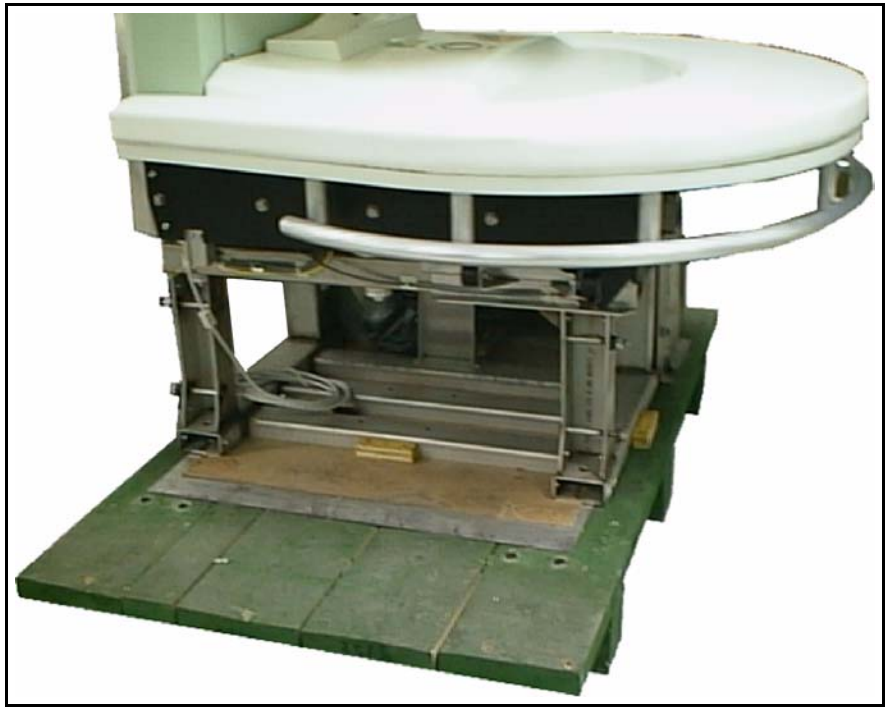
The following figure shows the wheels correctly installed, the removable lift point installed and the two different wheel orientations.

Fig. 89: Metallic structure with wheels, pivot and pulling hook



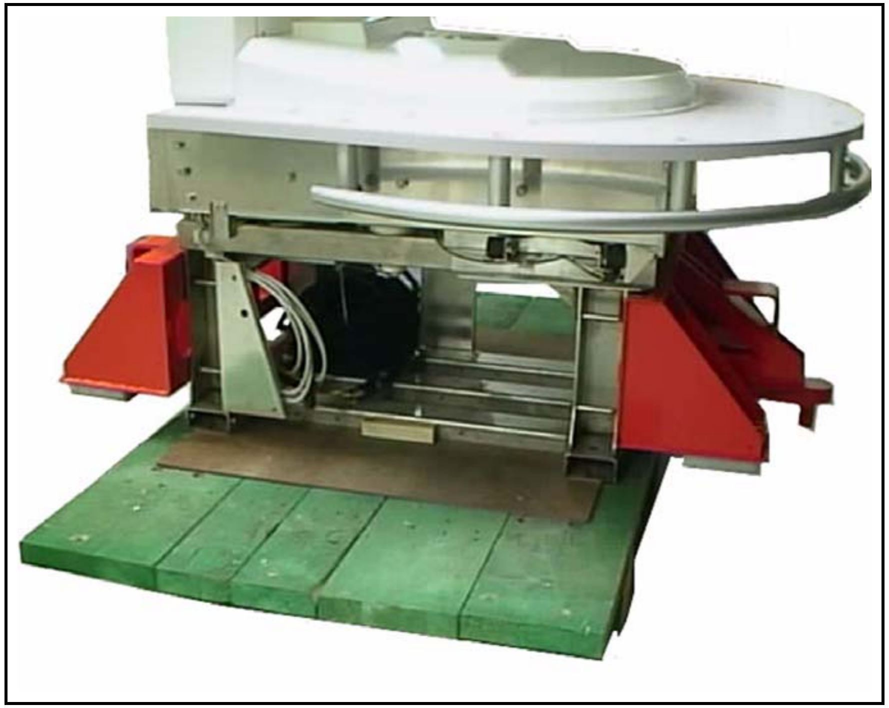
The next two figures show the magnet base without the four metallic angles and with the two metallic structures.

Fig. 90: Magnet and pallet without the four metallic angle



⚠**WARNING** **THE WHEELS MUST BE INSTALLED BEFORE THE GUIDE TO AVOID MAGNET INSTABILITY**

Fig. 91: The two metallic structures are mounted on the magnet base



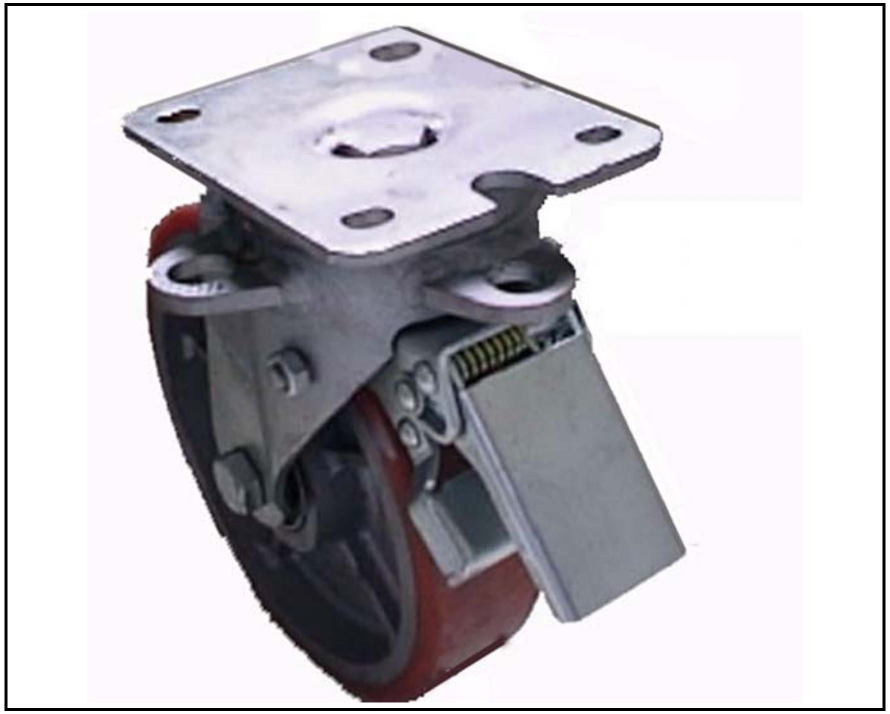
Wheels installation

When the metallic structures are mounted you must install at least two wheels, usually on the rear side of the magnet.

First of all lock the wheels by pushing the wheel brake pedal, as shown in the following figure. Slots make it possible to attach the wheels to the metallic structure

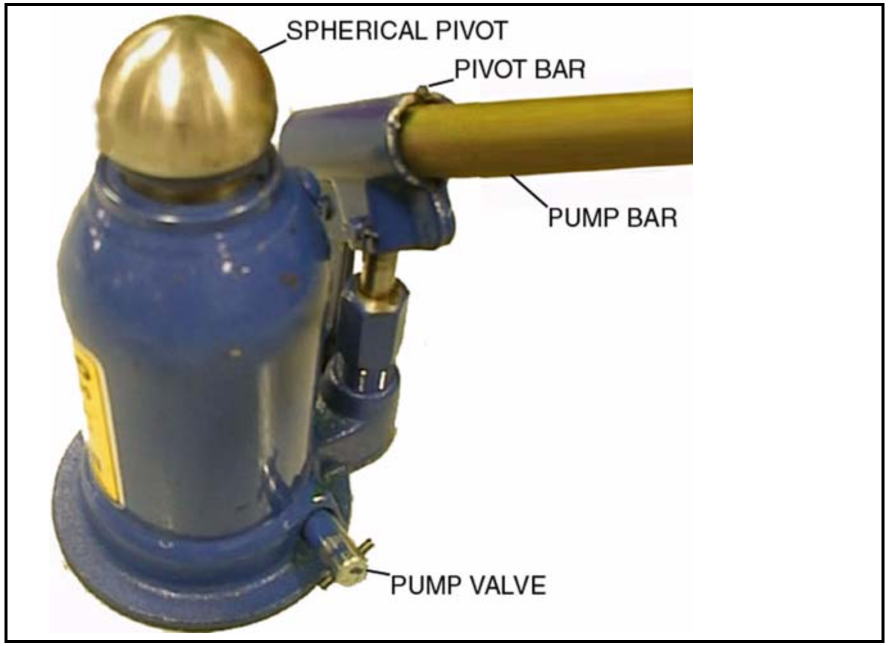
One pedal and one brake comprise the brake mechanism: to lock the wheels push down the pedal; pull it up to release the brake.

Fig. 92: Stop the wheel before to install it



Put the pump under the removable lift point of the metallic structure. The pump bar must be inserted and locked on the pump by the pivot bar, as shown in the following figure.

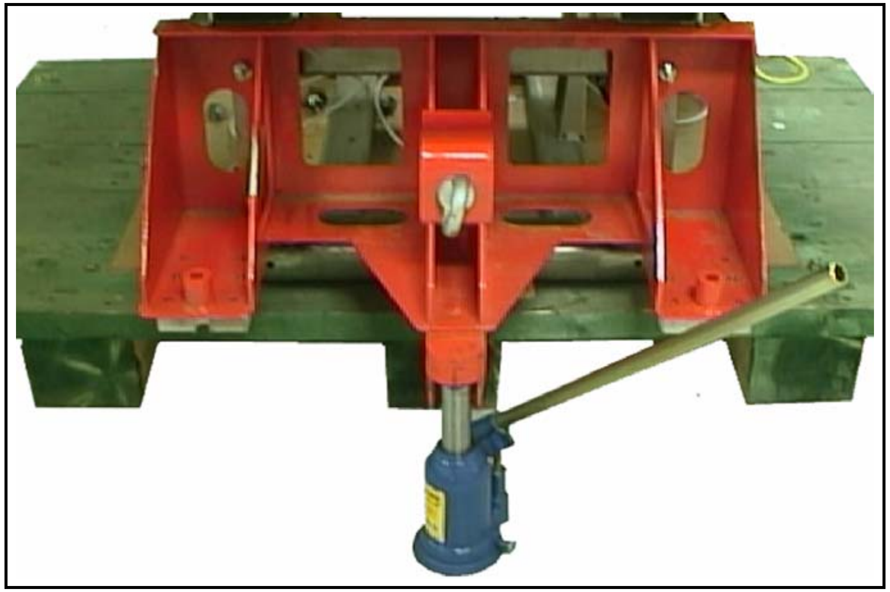
Fig. 93: Pump with spherical pivot and bar mounted



⚠WARNING DO NOT UNSCREW THE VALVE TOO MUCH TO AVOID OIL DISPERSION!!!

Push the pump bar down and pull it up a few times to lift the magnet, as soon as possible insert the wheels under the metallic structure and fix them on it using four bolts and nuts per wheel (found in the tool bag contained in the installation kit). Every wheel can be turned and you can lock it in different positions: parallel to the magnet longitudinal axis and 90° to it.

Fig. 94: Lift the magnet rear side and install the whe els



To lock the wheel, use the pivot shown in Fig: Metallic structure with wheels, pivot and pulling hook. Use the pulling hook to move the magnet on the ramp or if the installation room is very far away.

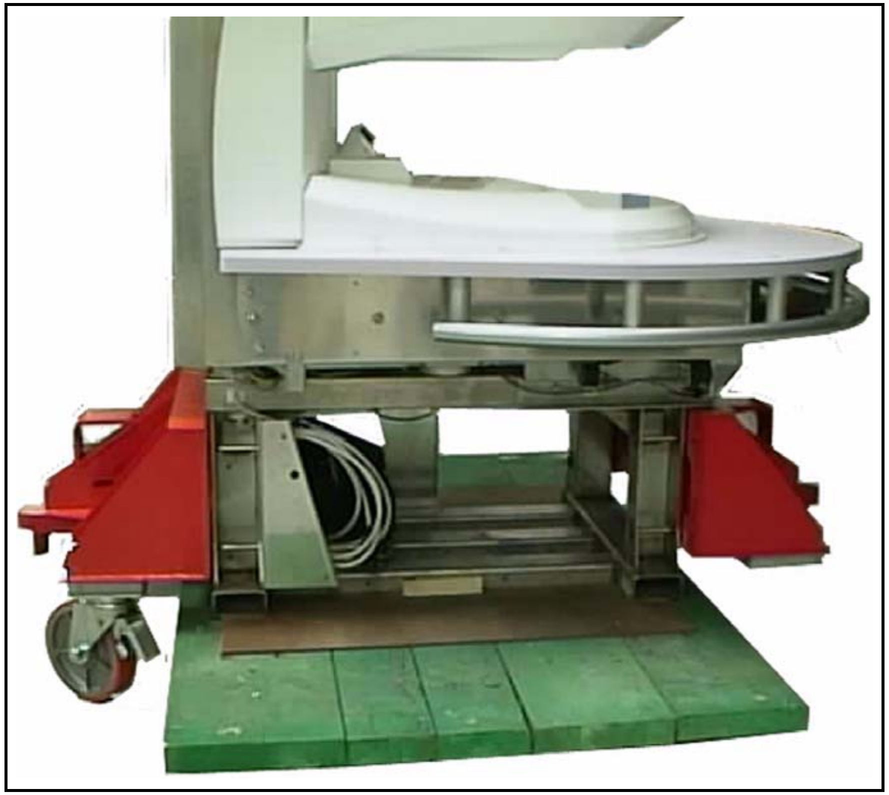
⚠WARNING THE FOUR WHEELS MUST BE INSTALLED AND LOCKED BEFORE USING THE PULLING HOOK!!!

⚠WARNING MAXIMUM RAMP INCLINATION 10%!!!

⚠WARNING THE PAVILION RAMP IS NOT DESIGNED FOR THE MAGNET'S WEIGHT, STEEL PLATES MUST BE USED INSIDE THE PAVILION AS WELL!!!

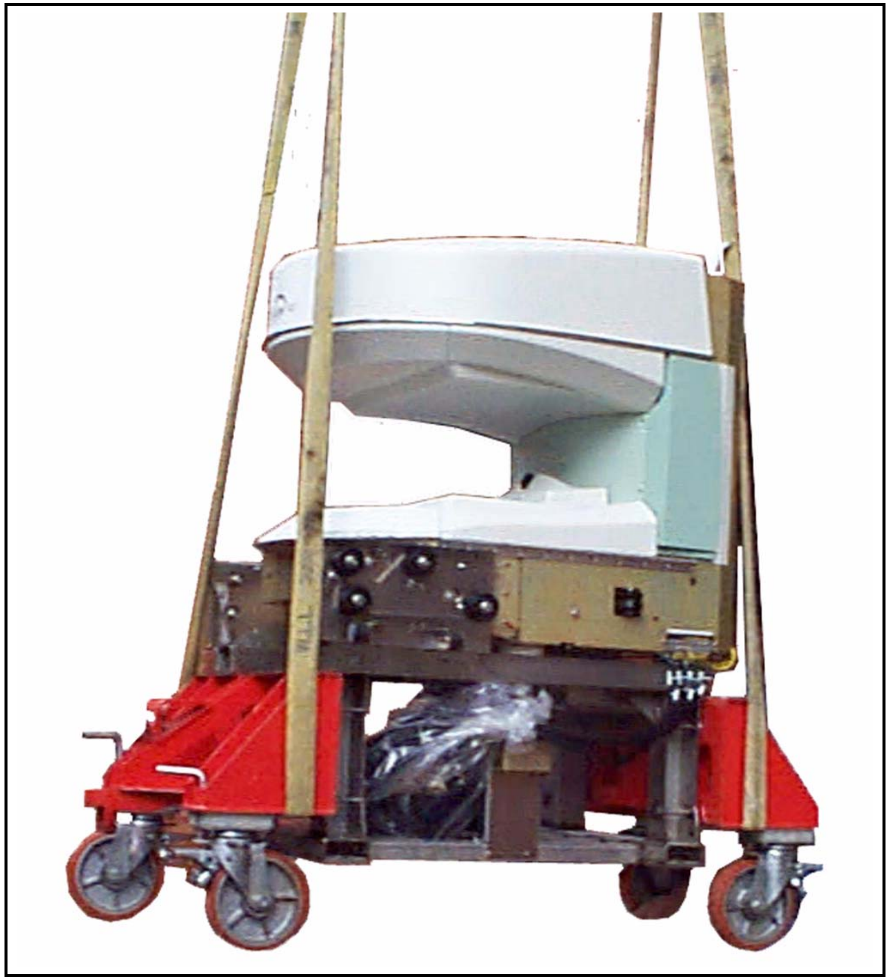
The pump can be removed after installing the wheels: take out the bar from the original position and use its hollow to turn the pump valve clock wise, carefully, to decrease the pump and the height of the magnet. Then turn the valve anti-clockwise to close it.

Fig. 95: Wheels installed and pump removed



If you have to lift the Magnet perform this operation like shown in the next figure.

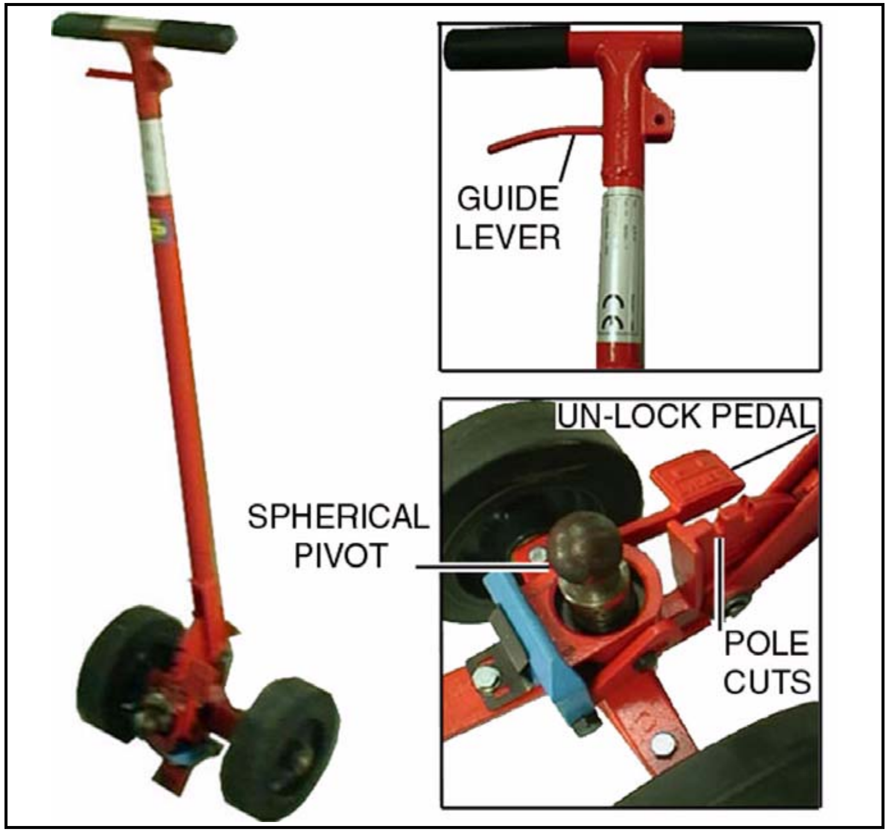
Fig. 96: How to correctly lift the Magnet



Guide installation

As for the pump, a spherical pivot is fitted on the guide. Remove the removable lift point from the rear metallic structure and install it on the front metallic structure, now put the spherical pivot close to it to place the carriage on the structure, explained in the following points.

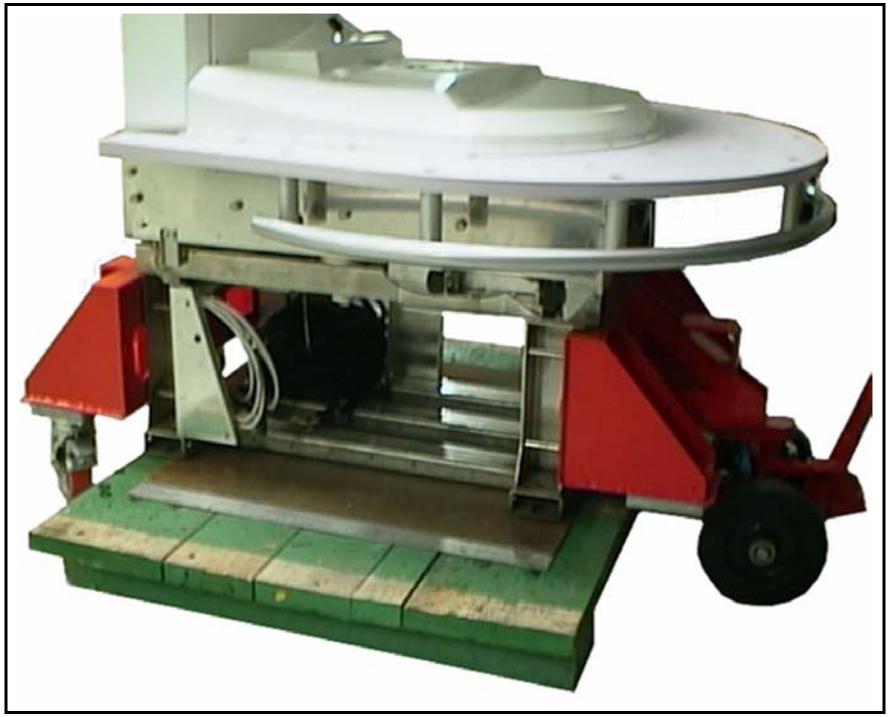
Fig. 97: Guide



- Using the guide lever, put the carriage pole in the lowest position and lock it; put the spherical pivot close to the lift point

- With two hands on the end of the pole and one foot on one carriage wheel, push the carriage pole down until the spherical pivot is inserted

Fig. 98: Guide and wheels correctly installed



⚠**WARNING** **For safety reason we suggest to install two wheels also on the Magnet front side together with the Guide!!!**

- If the carriage is correctly installed, the magnet is higher than the pallet and you can remove it, as shown in the following figure (with the guide and wheels installed)

Fig. 99: Magnet without pallet

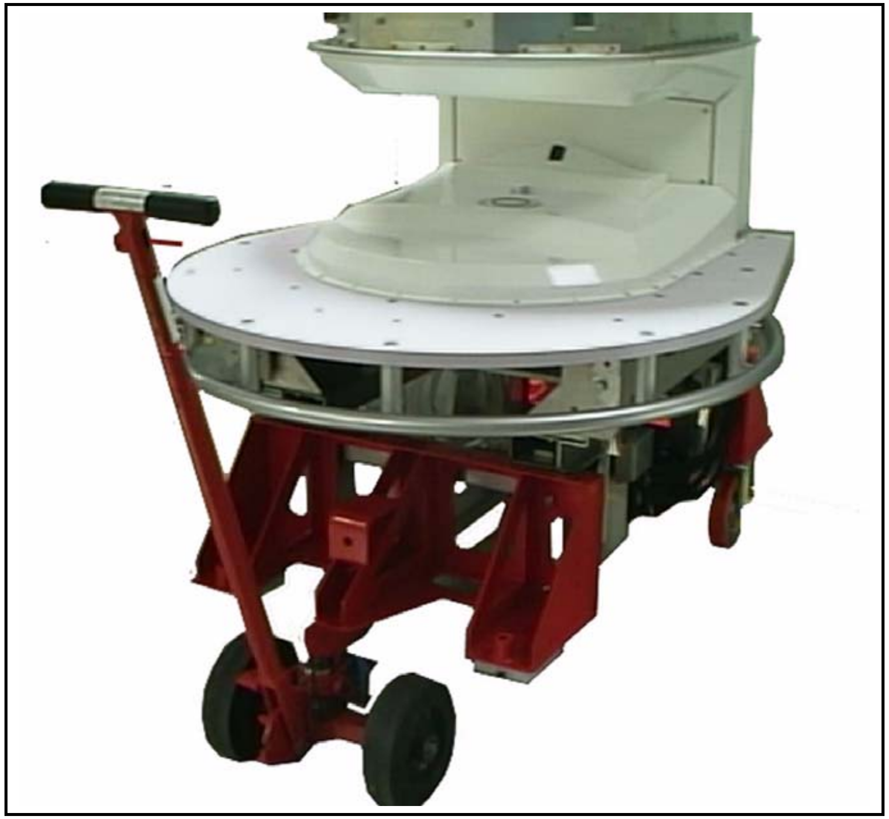
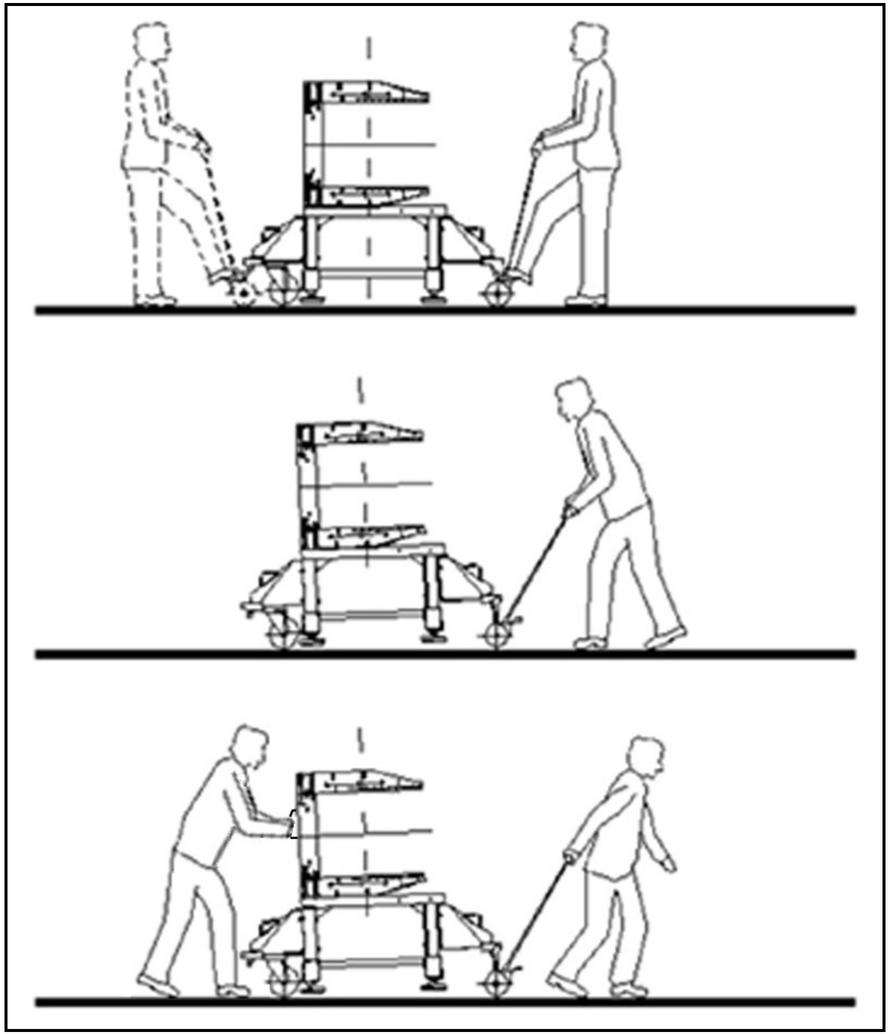


Fig. 100: How to Use the Guide



- The three slots on the guide are used to lock the carriage pole in different positions. The different possible positions are low, middle and high
- Now the magnet can be moved to the installation room

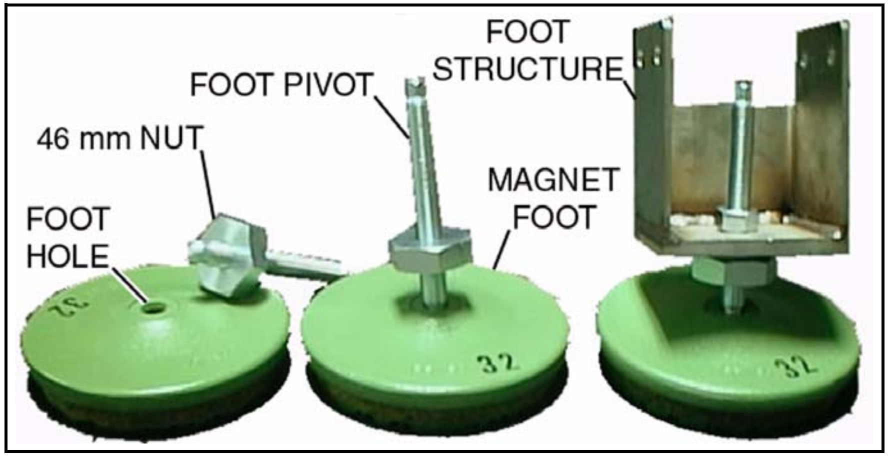
⚠**WARNING NEVER PUSH OR PULL THE MAGNET USING THE GUIDE, IT'S JUST FOR STEERING!!!**

Feet installation

When the magnet is in its final position mount the two feet at the front and the two feet at the back, following this steps:

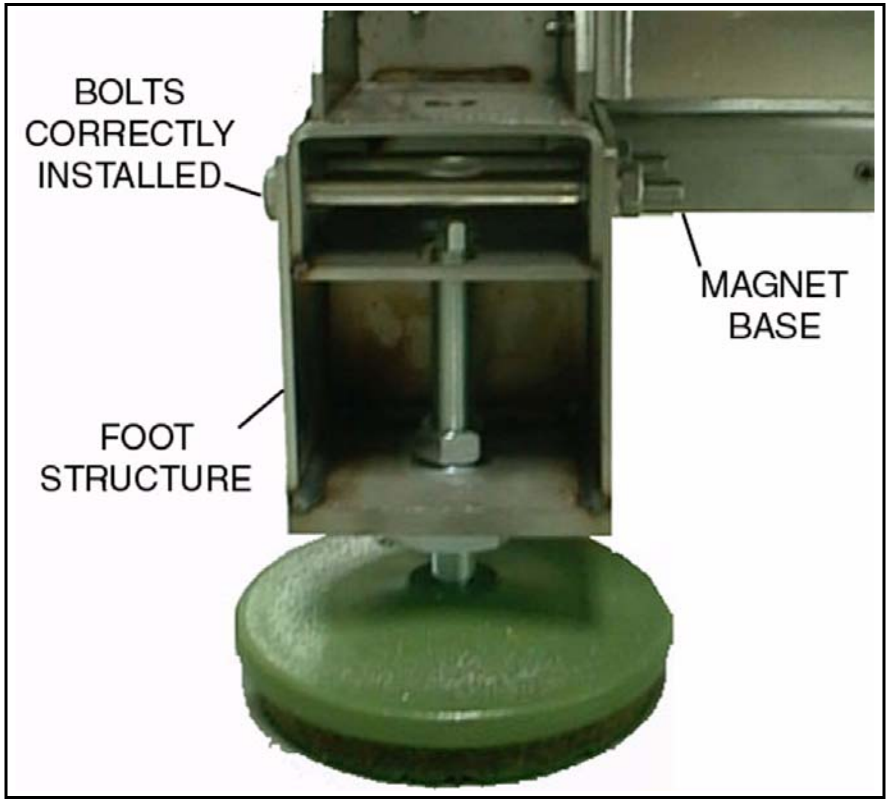
- Screw the 46 mm nut on the foot pivot and push the spherical sides of the pivot inside the foot hole as shown in the following figure
- Install the 125 mm diameter Feet on the front Magnet side and the 150 mm diameter feet on the back Magnet side

Fig. 101: Feet assembling



- Fix foot and pivot on the foot structure, insert the washer and the nut but leave one centimeter between the upper and the lower nuts. Fix the upper nut only when you are sure that the magnet is in the correct position, height and level. You can use the foot 46 mm foot pivot nut to increase or decrease the magnet height but only for small adjustments. Re-install the carriage if you need to make large adjustments
- Fix the foot structure on the magnet base using two bolts, washers and nuts. In order to reduce the dimension to the minimum insert the bolt as shown in the following figure.

Fig. 102: Foot structure correctly installed



Removing the guide and wheels

The magnet is in its final position and now the carriage and the wheels must be removed to install the four fixed feet.

⚠**WARNING** **THE GUIDE MUST BE REMOVED BEFORE THE WHEELS TO AVOID MAGNET INSTABILITY**

Operate as follows:

- Use the brake to lock the wheels
- Put the carriage pole in the lowest position
- Push the guide unlocking pedal to remove the carriage
- Put your hands on the carriage pole and pull it with care
- Remove the lift point and place it on the rear metallic structure
- Place the pump on the lift point and lift up the magnet
- Remove the wheels and then the pump

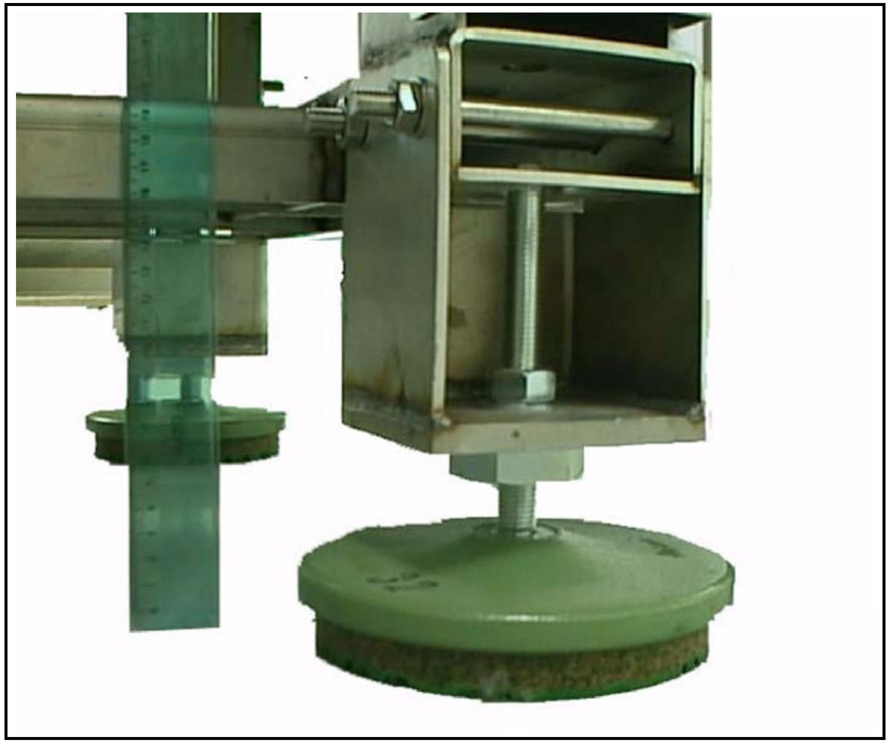
⚠**WARNING** **THE METALLIC STRUCTURES MUST BE REMOVED AFTER THE MAGNET LEVEL AND HEIGHT CHECKS**

Magnet level and height checks

If it's possible perform these checks the day after the Magnet mechanical installation. Check the magnet height putting a tape measure between the edge of the magnet base and the floor, as shown in the following figure. The correct height of the Magnet basement (lower edge to the floor) is **17 cm** (anyway not higher then 18 cm).

⚠**WARNING** **Maximum Magnet height 18 cm!!!**

Fig. 103: Correct magnet height

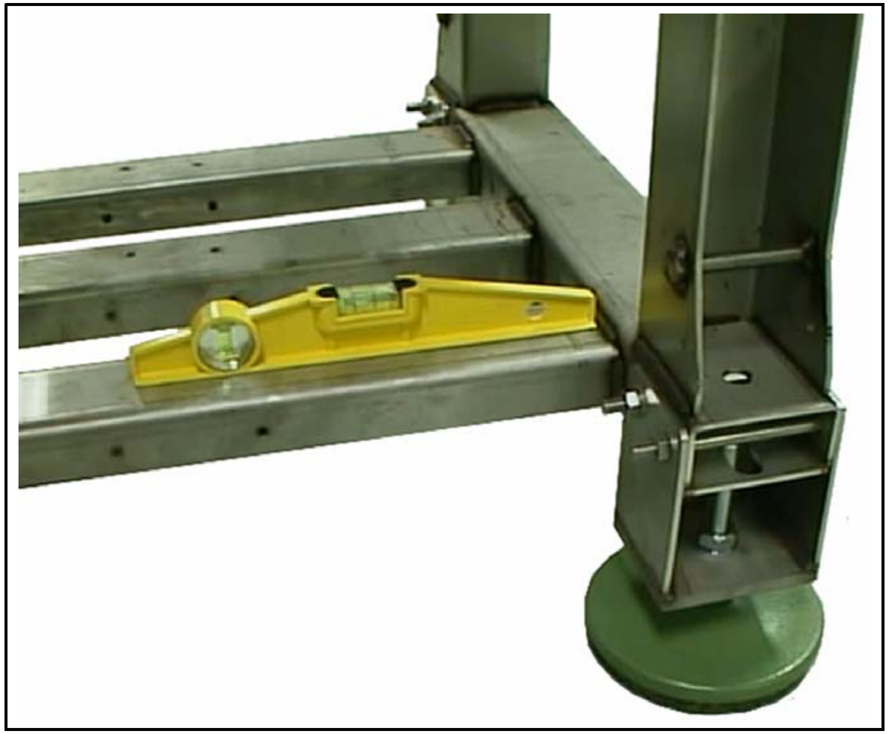


If the magnet height is not correct, position the guide and screw the 46 mm feet pivot nut

Put the spirit level on the magnet base in two different positions and check if the magnet is correctly installed.

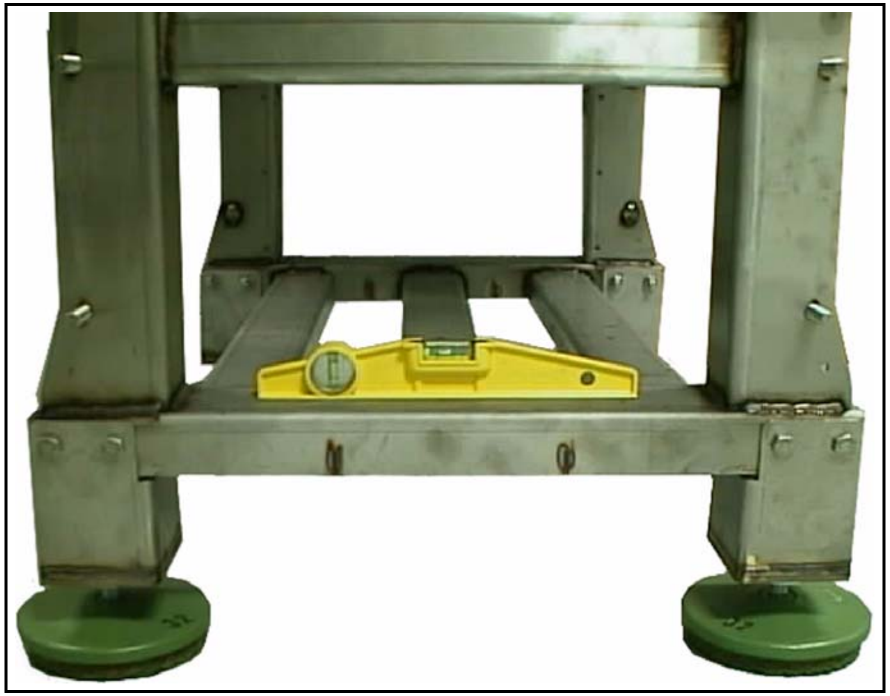
This operation is very important because only if the magnet is in the correct position is it possible to install and use the patient bed correctly.

Fig. 104: Check the magnet level



You can compensate for floor difference, just by rotating the foot pivot nut, using two spanners: one on the foot pivot head and the other one on the 46 mm pivot nut.

Fig. 105: Check the magnet level



Removing metallic structures

At the end of the installation checks the metallic structure must be removed from the magnet base. Follow the procedure explained before for their installation, in reverse order.

Electronic Box Installation

- Move the Electronic Box (using its wheels) into the Pavilion in the pre defined position (left or right Magnet Side). The Electronic unit front and top covers are already mounted. Move it carefully and as shown in the next figure only!

Fig. 106: How to move the Electronic Unit

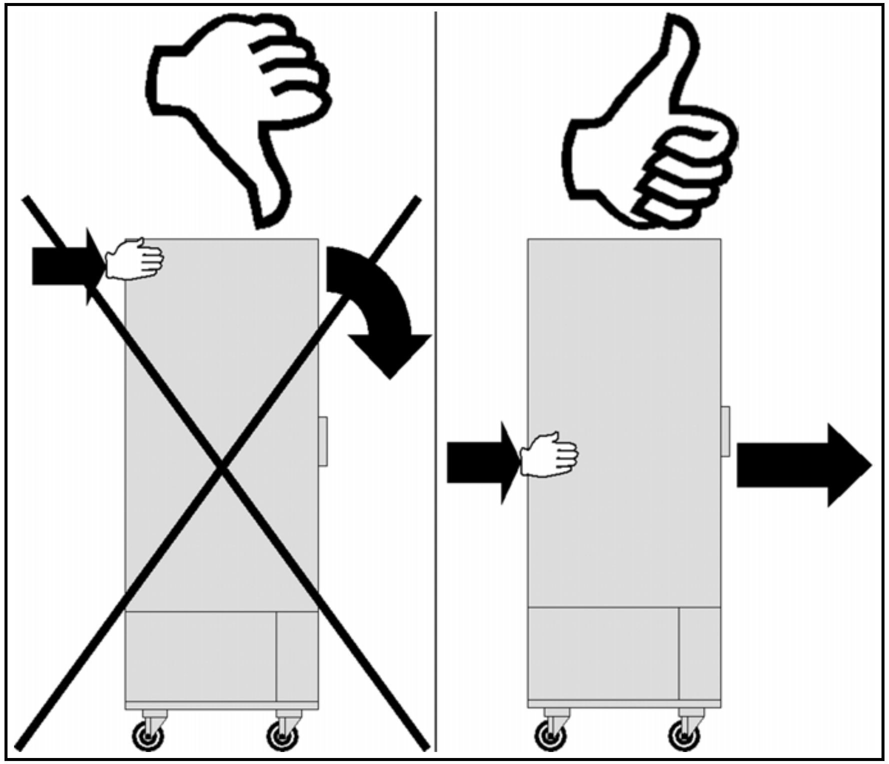
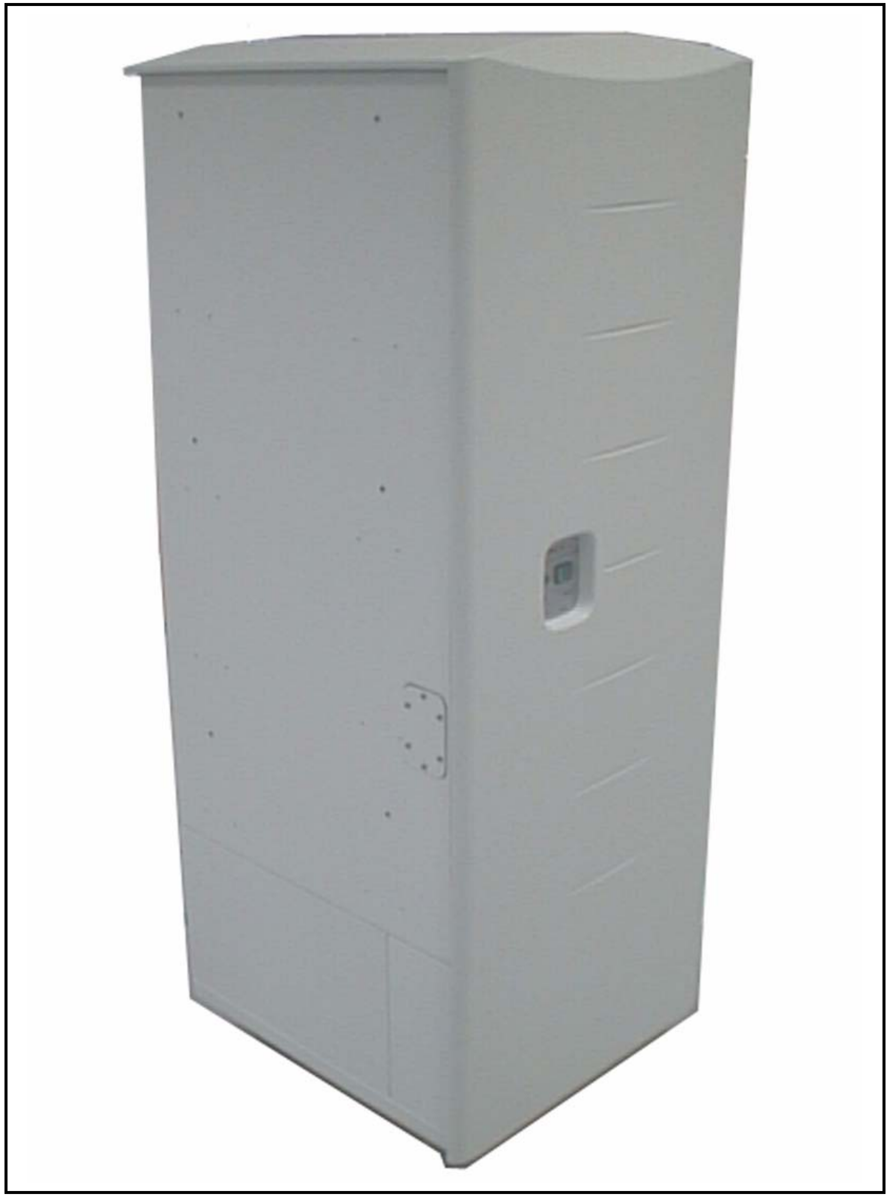


Fig. 107: Electronic Unit



- Remove the Front Cover sliding it up

Fig. 108: Electronic Unit without Front Cover

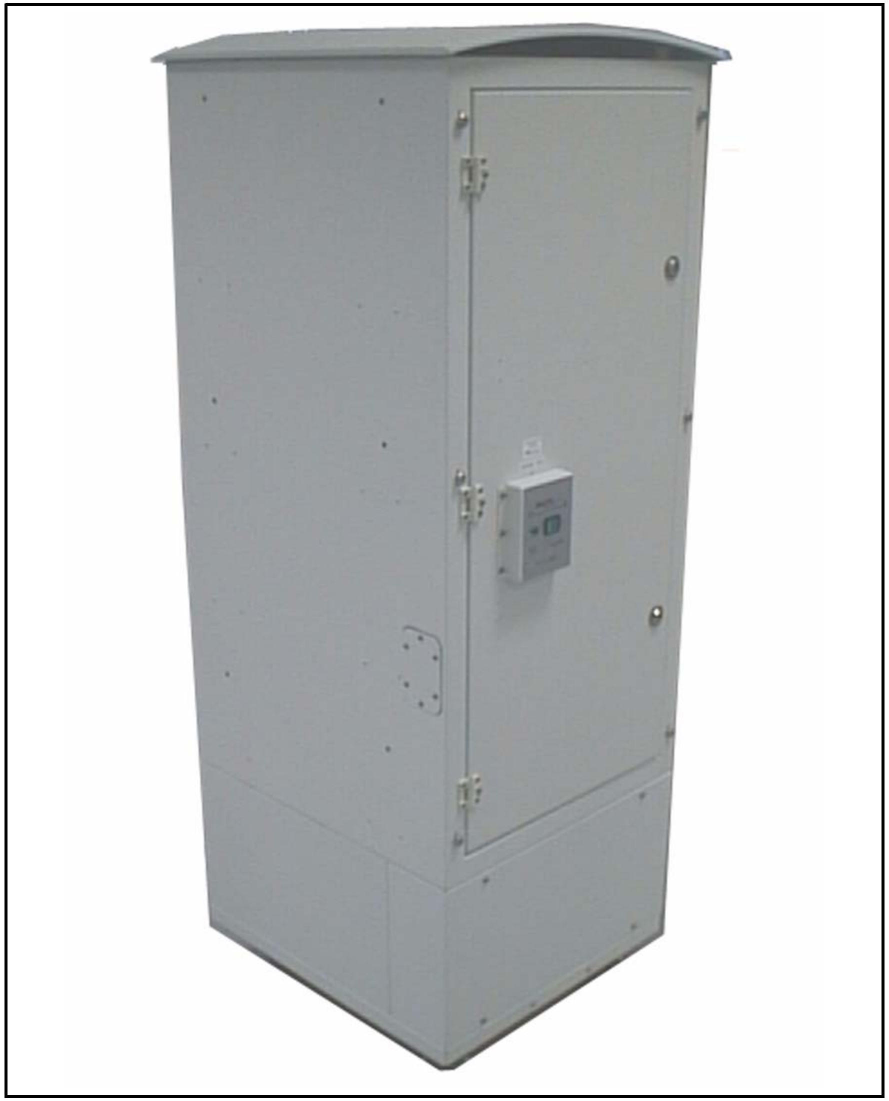
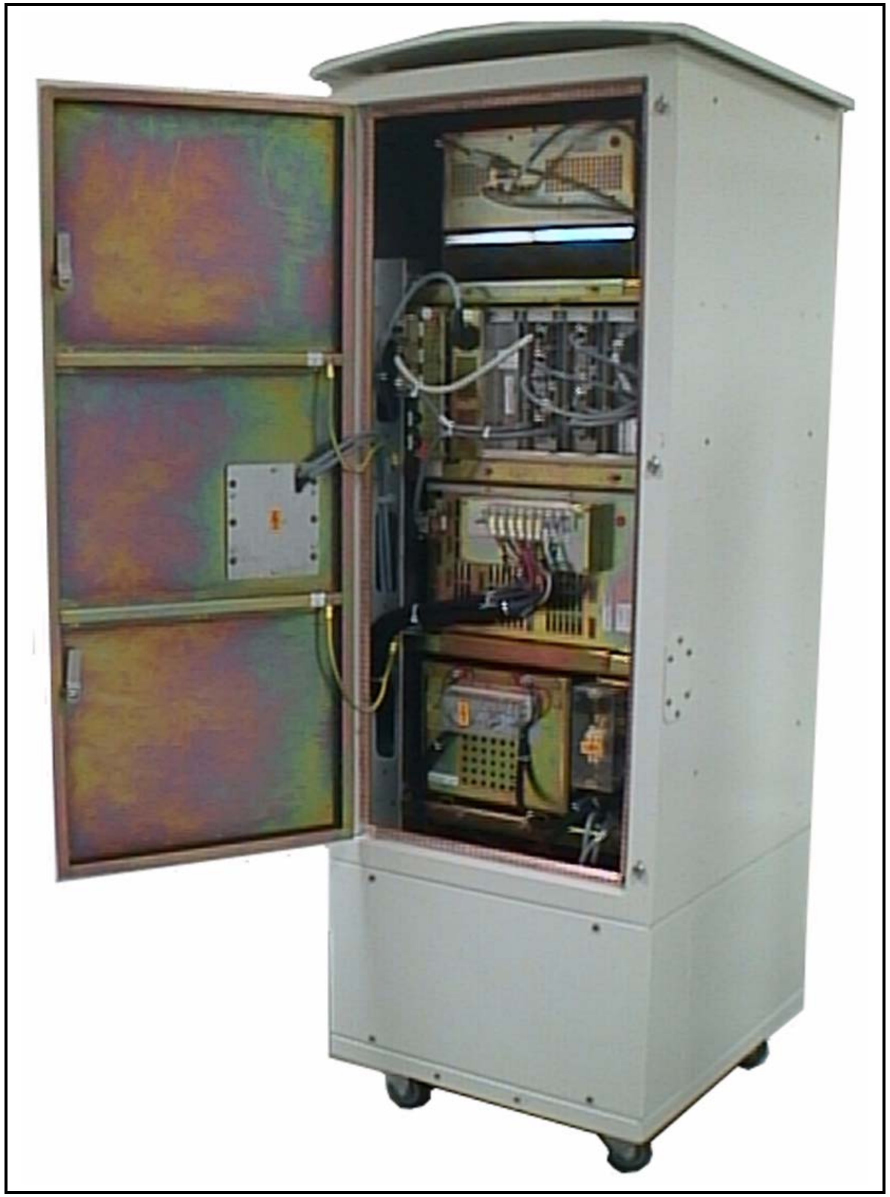
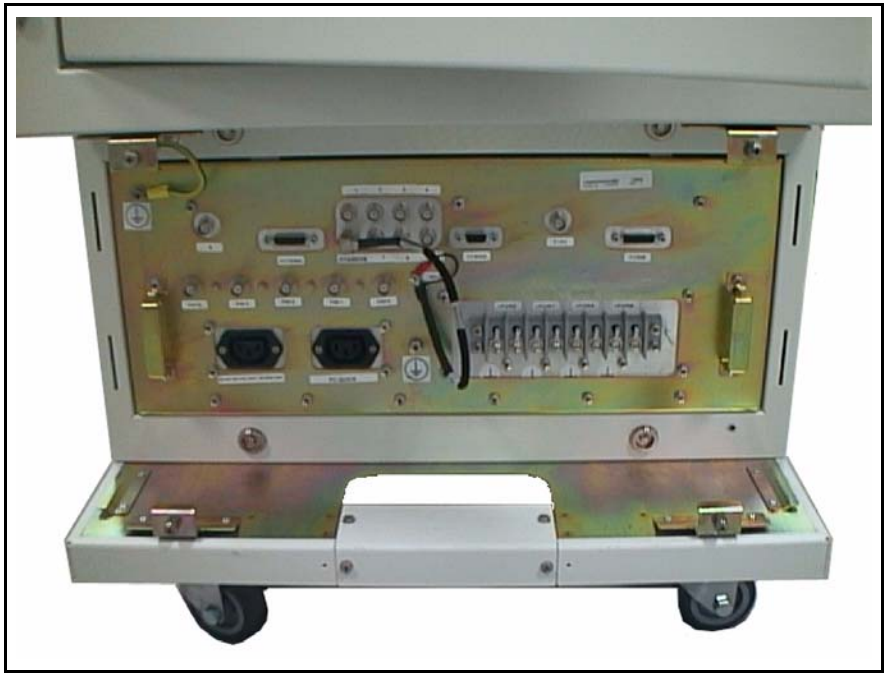


Fig. 109: Electronic Unit (right Magnet side configuration)



- Remove the Filter Panel cover from the Electronic Unit bottom side (remove four screws)

Fig. 110: Filter Panel



- Place all the Magnet Cables coming under the Electronic Unit through the hole present in the bottom side of the Filter Panel. The cables coming from the Magnet must be placed into a duct inside the RF Cage as well. If necessary, e.g. for cable connections checking, the Filter Panel can be moved forward

---

⚠**WARNING Check the aluminium plate of the Pavilion placed under the Electronic Unit: the cut to allow the cable connections must be present!!!**

Fig. 111: Opened Filter Panel

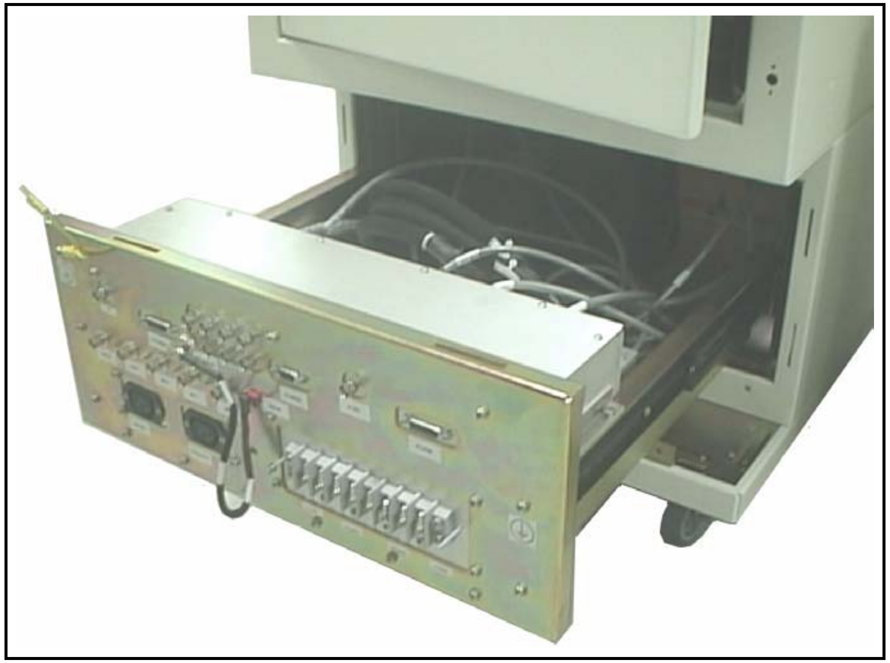
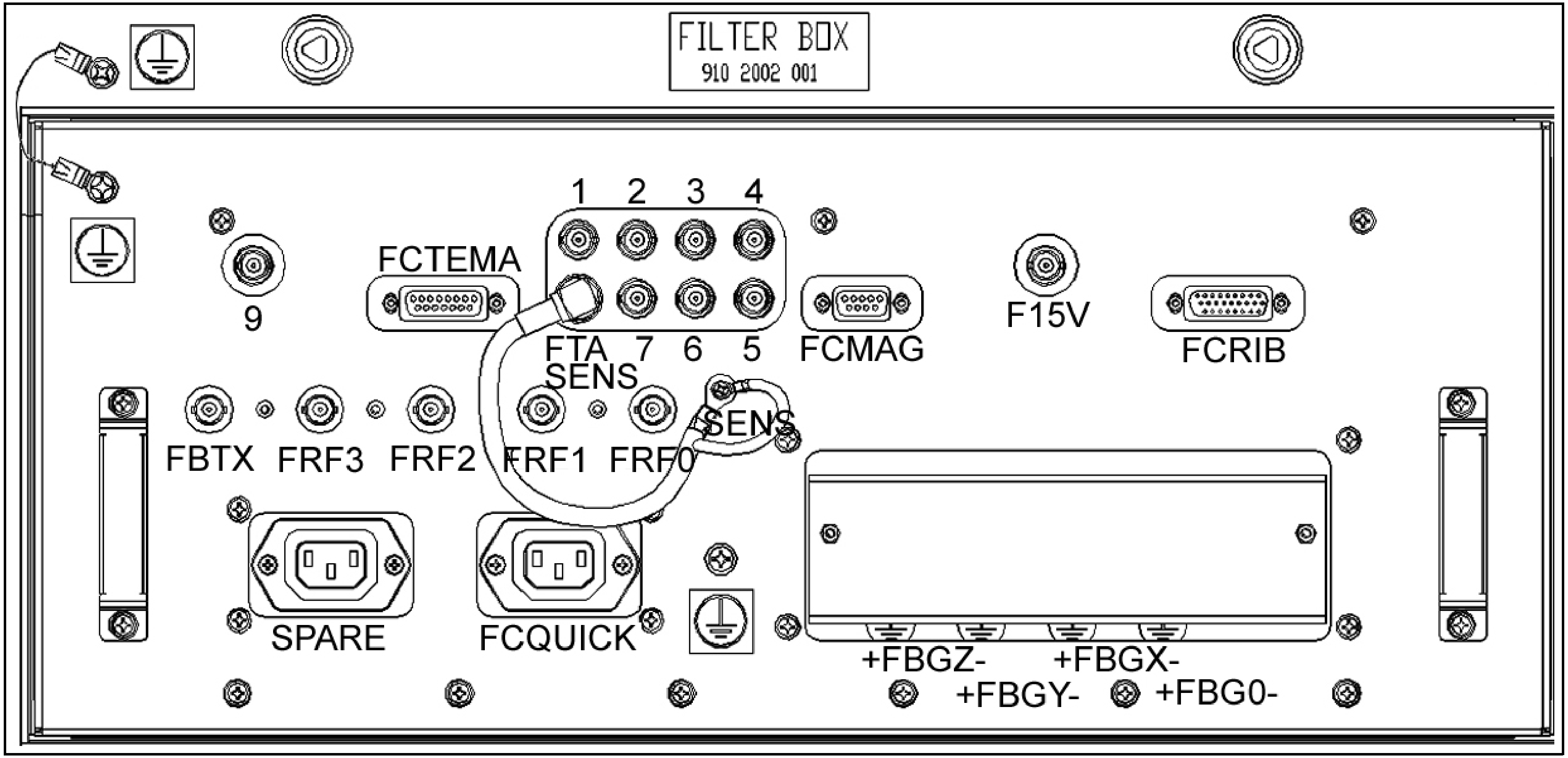


Fig. 112: Filter Panel



- Place the provided Wave Guide on the Electronic Unit in according with the pre-defined Electronic Unit location inside the RF Cage (left or right) removing the small cover used to close the cable passing hole. Place the special RF washer between the Duct and the Electronic Unit

Fig. 113: Wave Guide

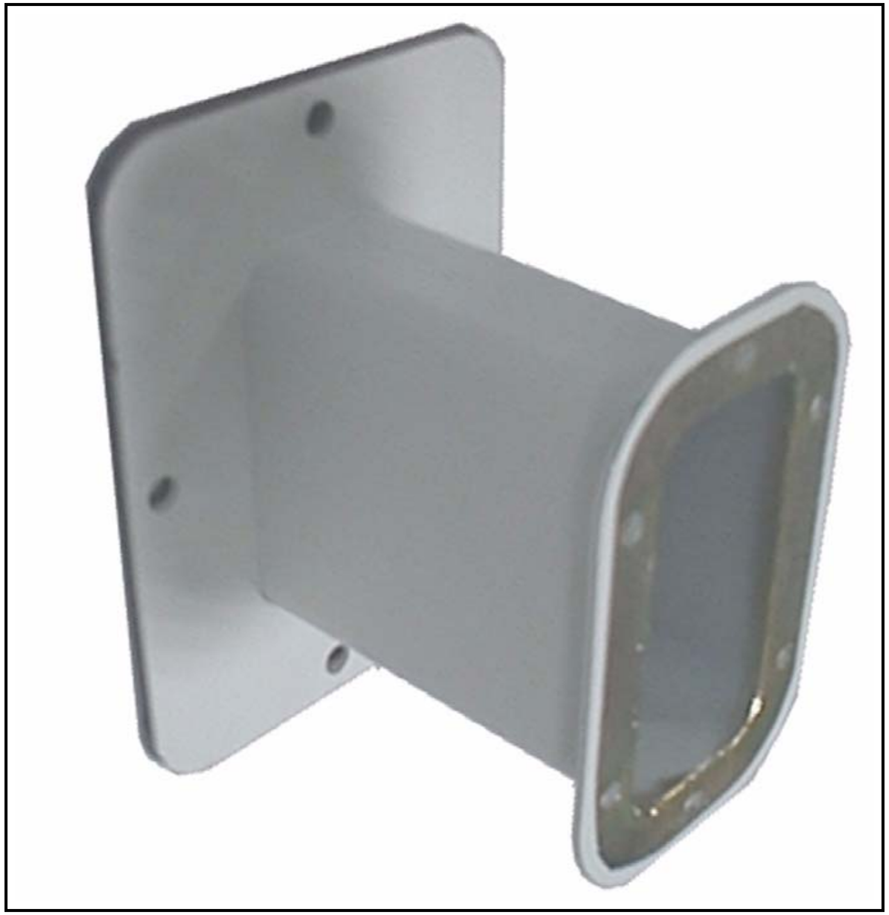


Fig. 114: Wave Guide Dimensions (Electronic Unit Side)

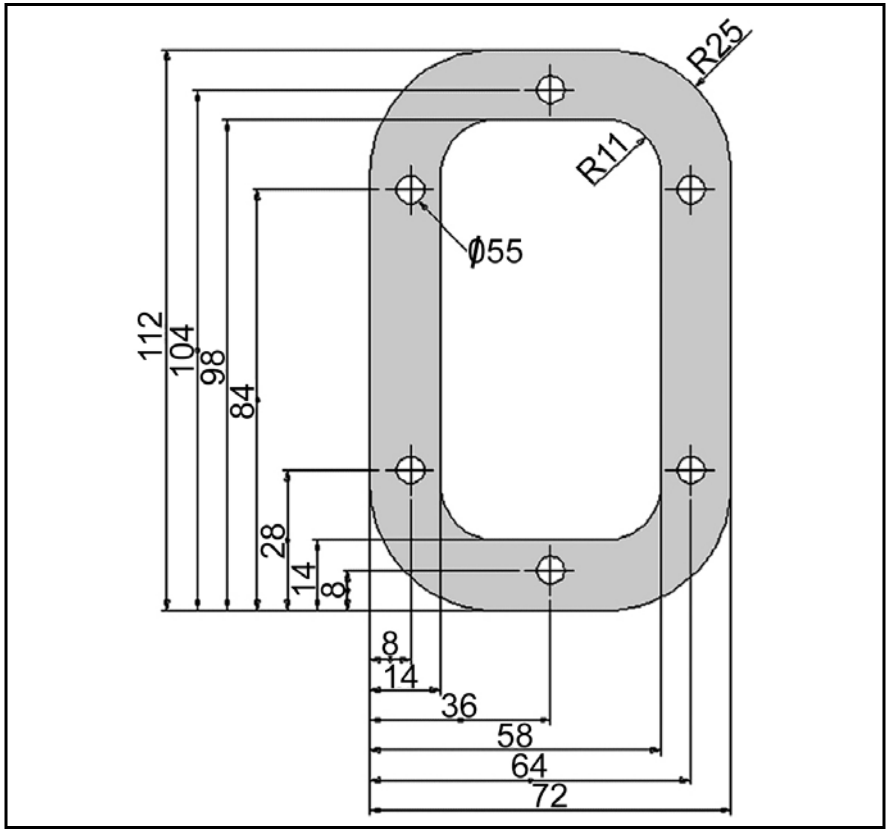
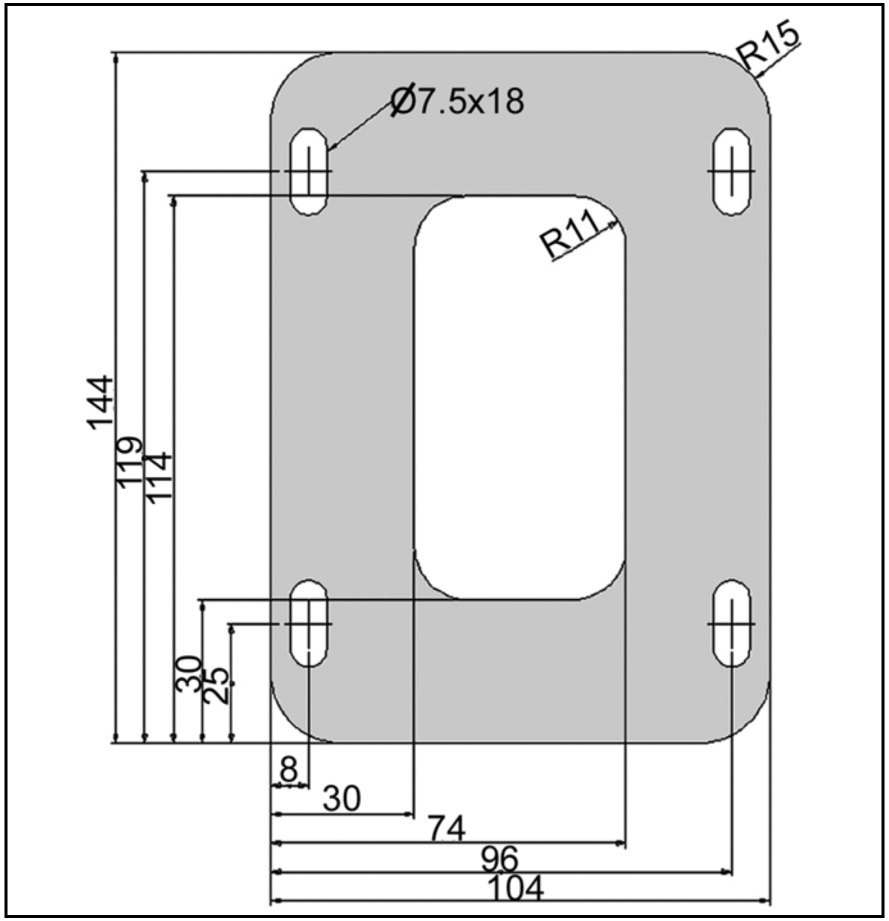


Fig. 115: Wave Guide Dimensions (RF Cage Side)



- Join the Wave Guide to the RF Cage using the metallic adapter plates if necessary (also external side). Remember that all the cables between the PC Unit and the Electronic Unit and the System Power Supply Cable must pass through it

---

CAUTION	**Before to join the Electronic Unit to the RF Cage, connect the PC Extension Power Cable to the rear side of the Power Distribution Box (open the small rear cover) passing the cable inside the Electronic Unit under the TRI module as shown in the next figure!!!**

Fig. 116: PC Unit Power Cable Passing

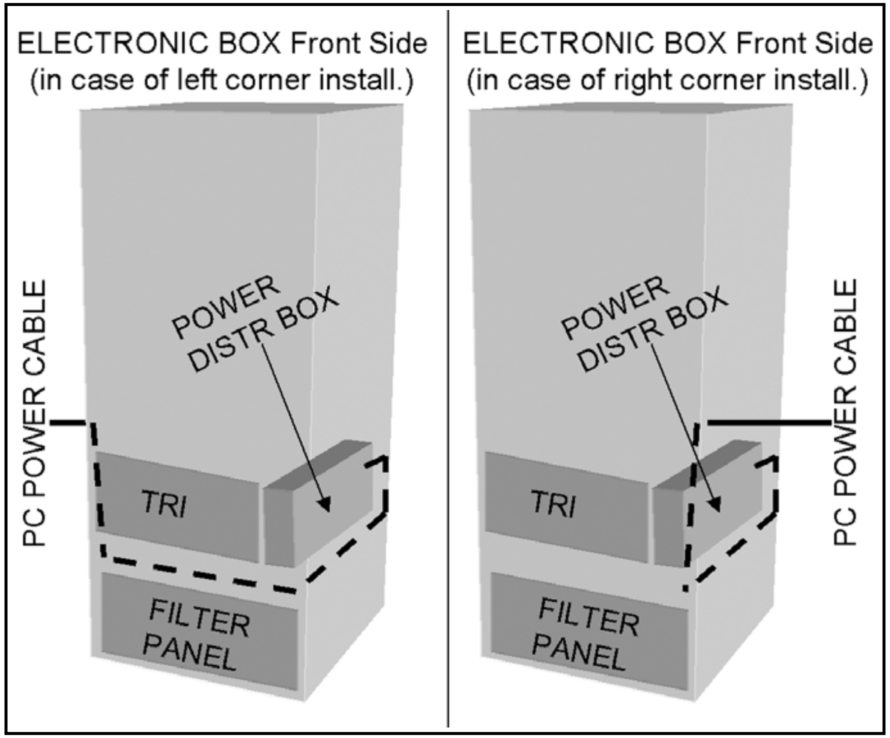

ELECTRONIC BOX Front Side
(in case of left corner install.)
ELECTRONIC BOX Front Side
(in case of right corner install.)
PC POWER CABLE
POWER DISTR BOX
TRI
FILTER PANEL
POWER DISTR BOX
TRI
FILTER PANEL
PC POWER CABLE

Fig. 117: Wave Guide and adapting plate

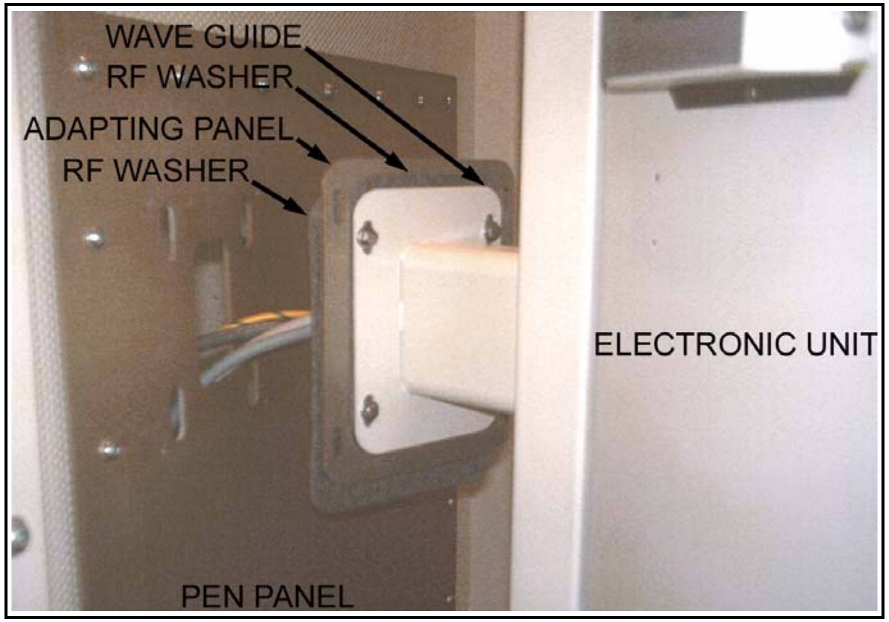
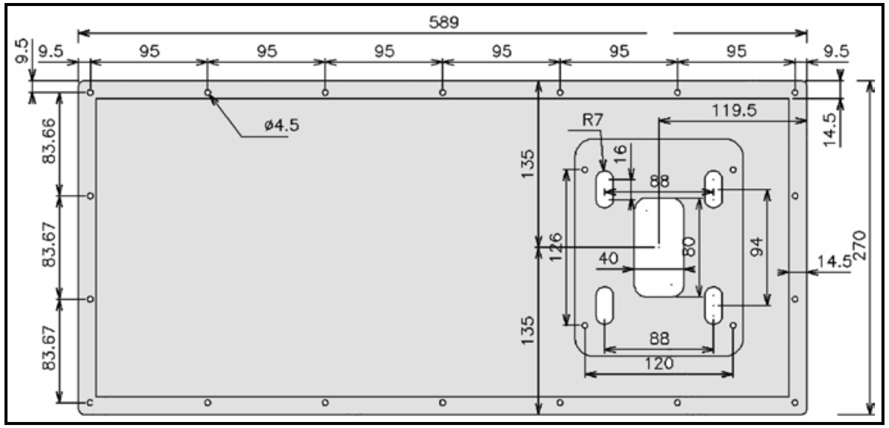
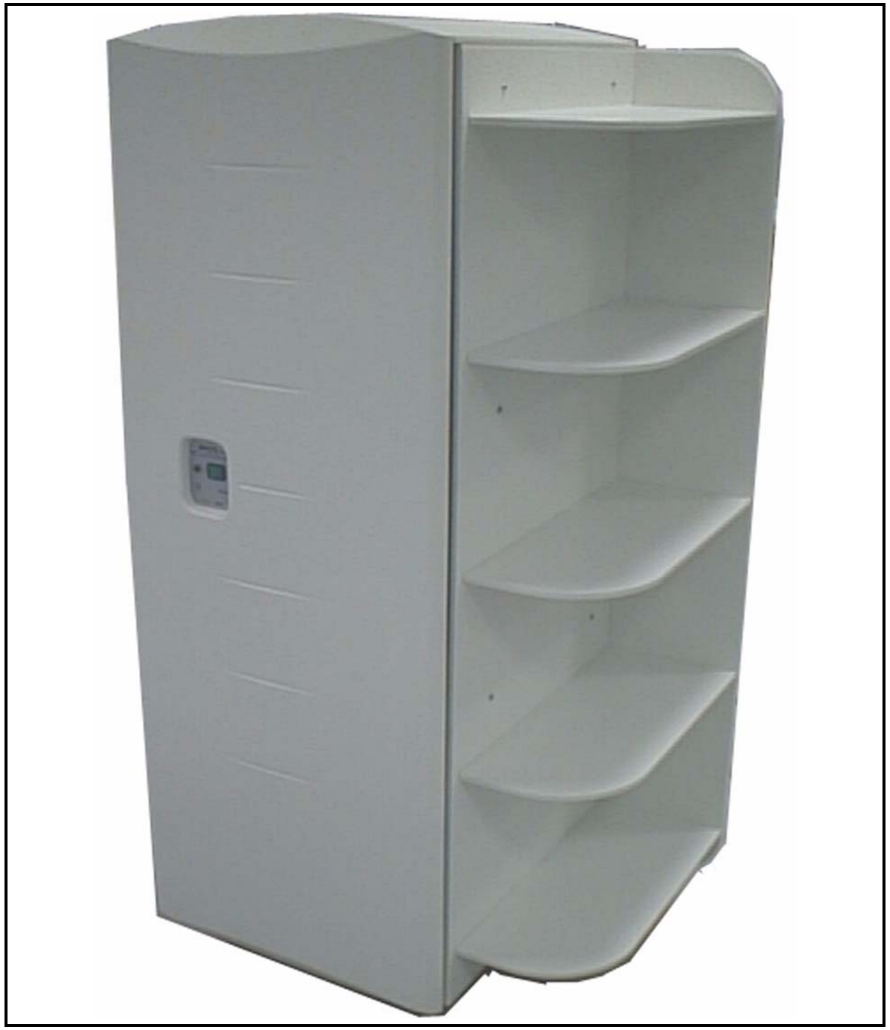


Fig. 118: Smaller adapter plate dimensions (external view)



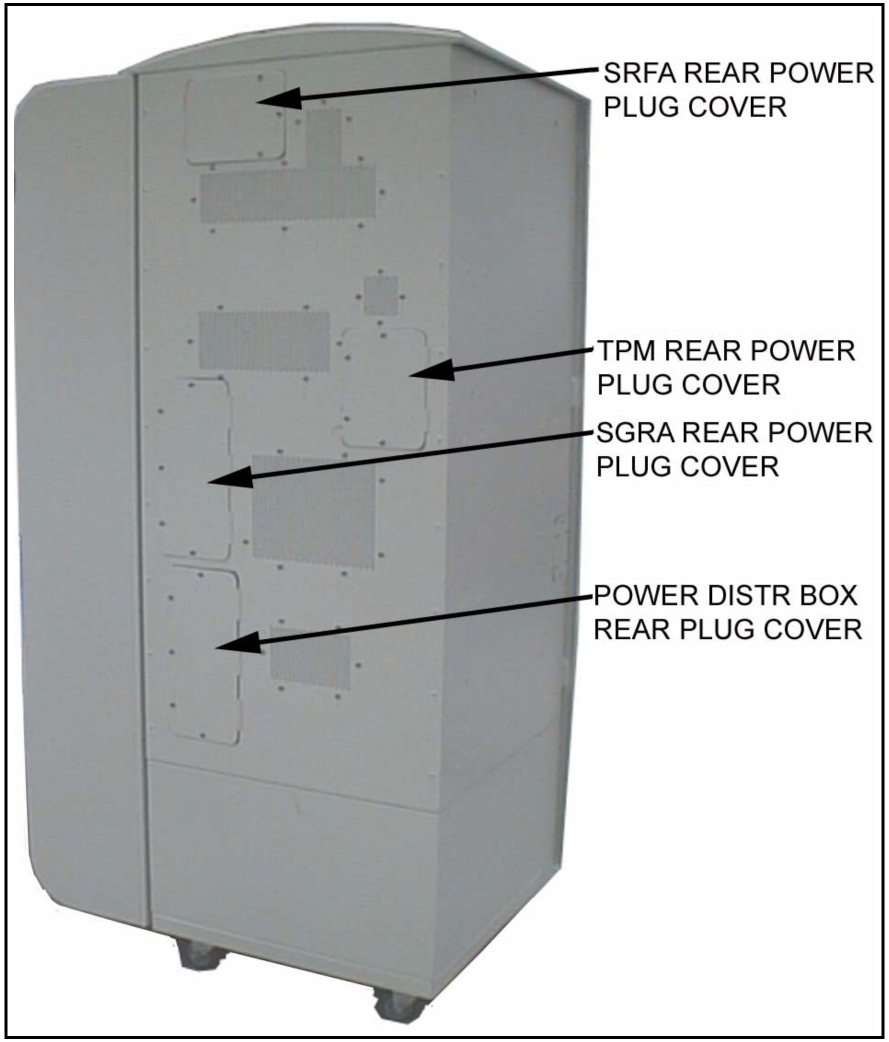
- Complete the Electronic Unit installation placing the Lateral Holders (can be mounted left or right in according with the Electronic Unit position)

Fig. 119: Electronic Unit Lateral Holders



- On the Electronic Unit rear side the small covers useful to have access to the modules power plugs are visible

Fig. 120: Electronic Unit Rear Covers


SRFA REAR POWER PLUG COVER
TPM REAR POWER PLUG COVER
SGRA REAR POWER PLUG COVER
POWER DISTR BOX REAR PLUG COVER

- Place the Coil Rack (optional) on the other Pavilion corner, also in this case the consoles can be mounted left or right

Fig. 121: Coil Rack (optional)

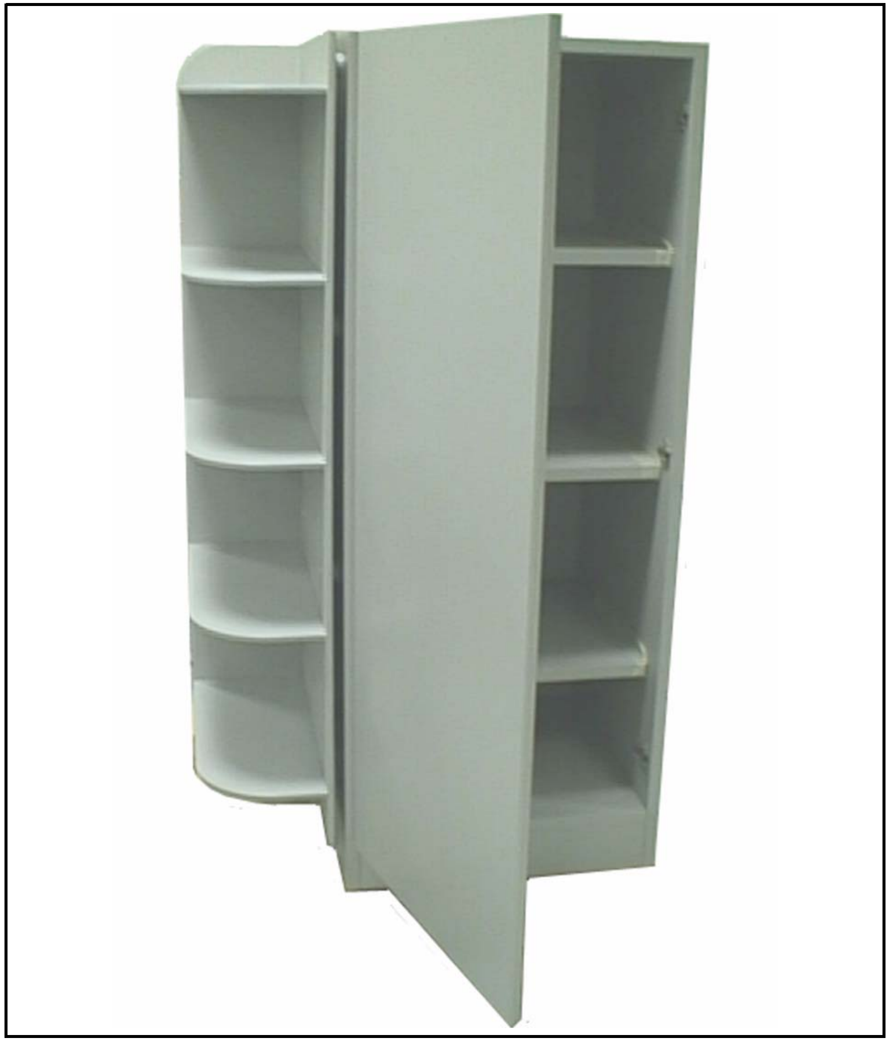
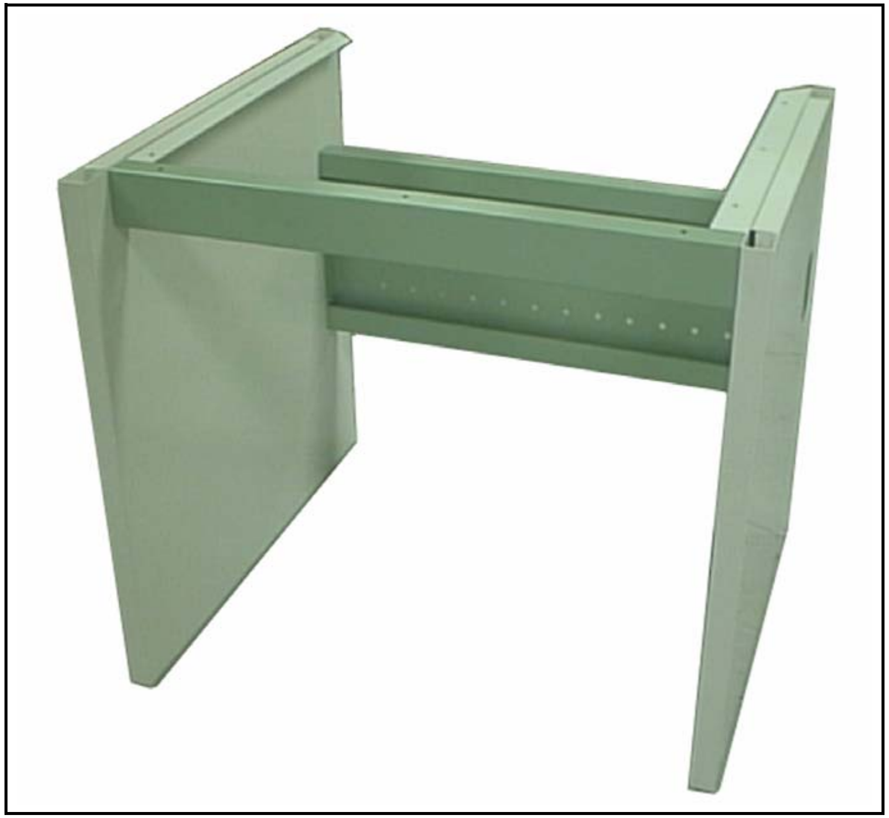


Table Assembling

Standard Version

- Mount the two table legs to the horizontal pieces

Fig. 122: Leg assembling



- Mount the legs to the lower face of the table plate and mount the lateral computer holder

Fig. 123: Table lower view

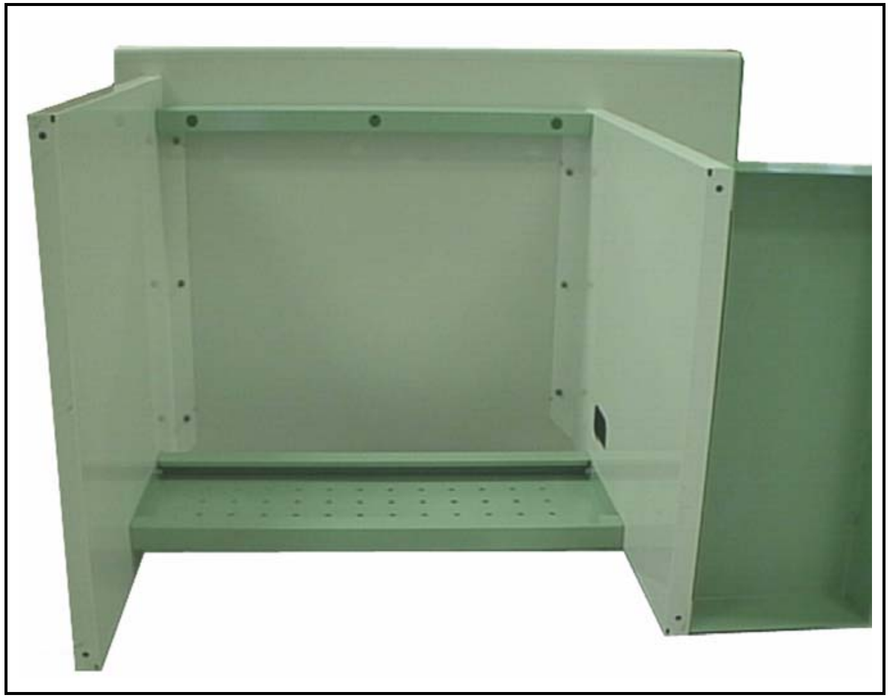
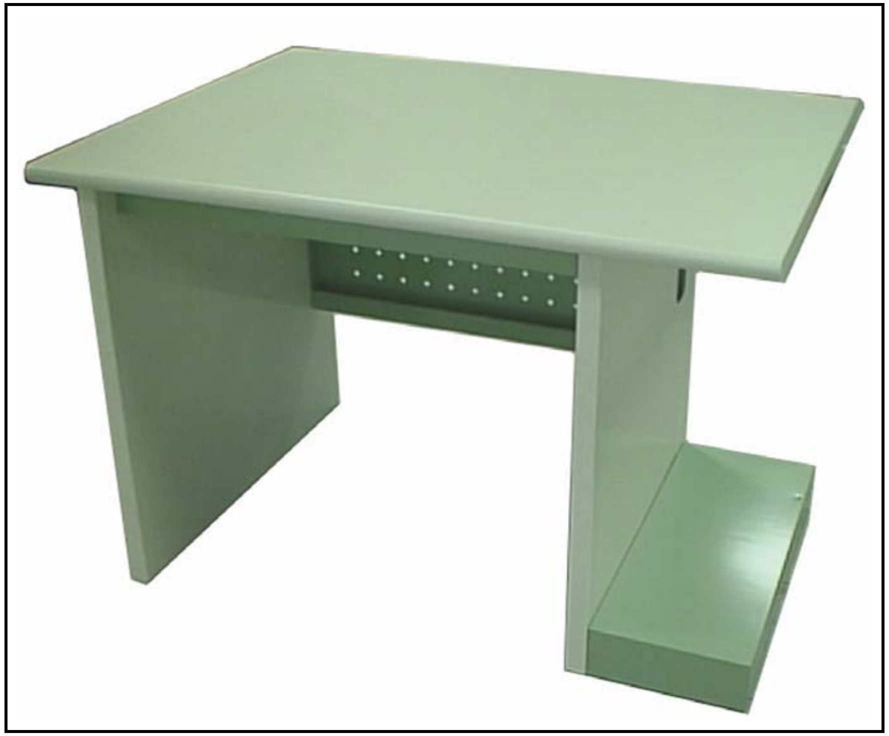


Fig. 124: Table front view



- Mount the rear computer cover taking care to insert before the power extension cable (like shown in the next two figures)

Fig. 125: Rear computer cover and power extension power cable

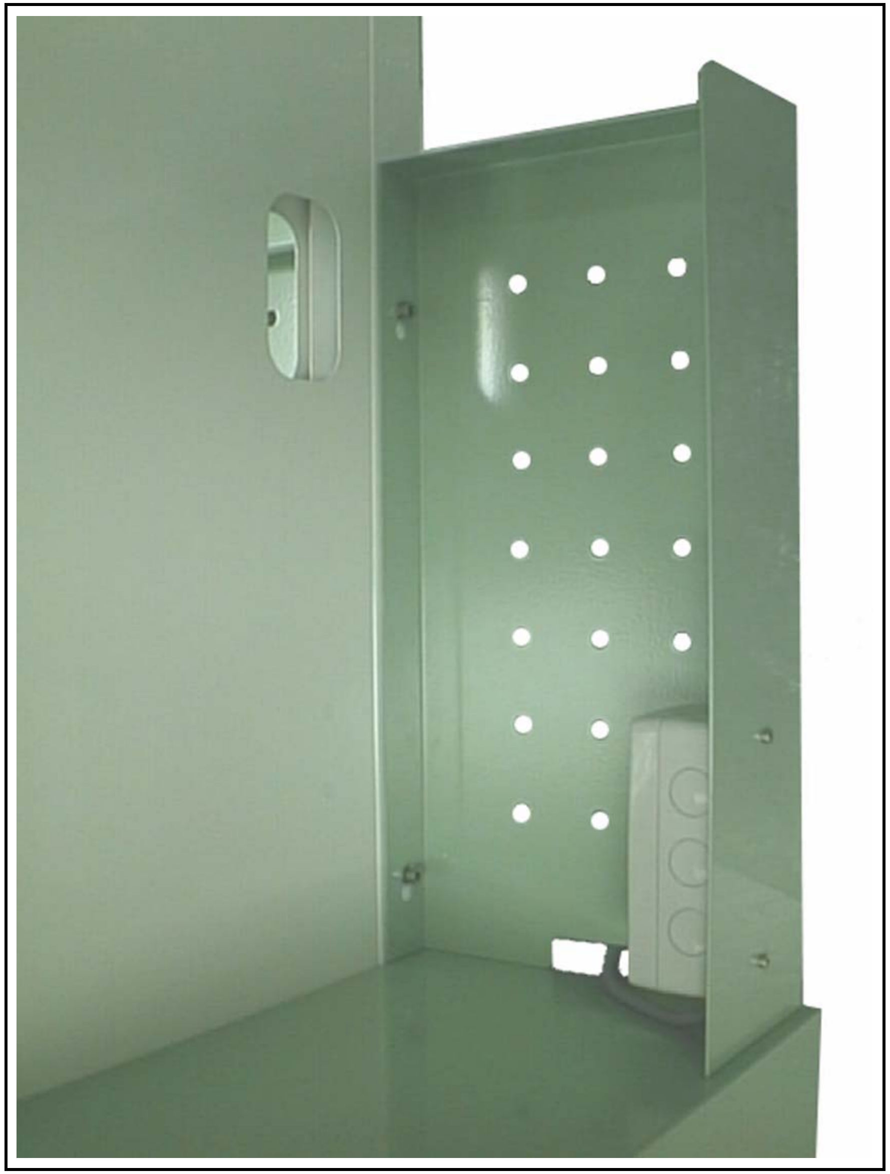
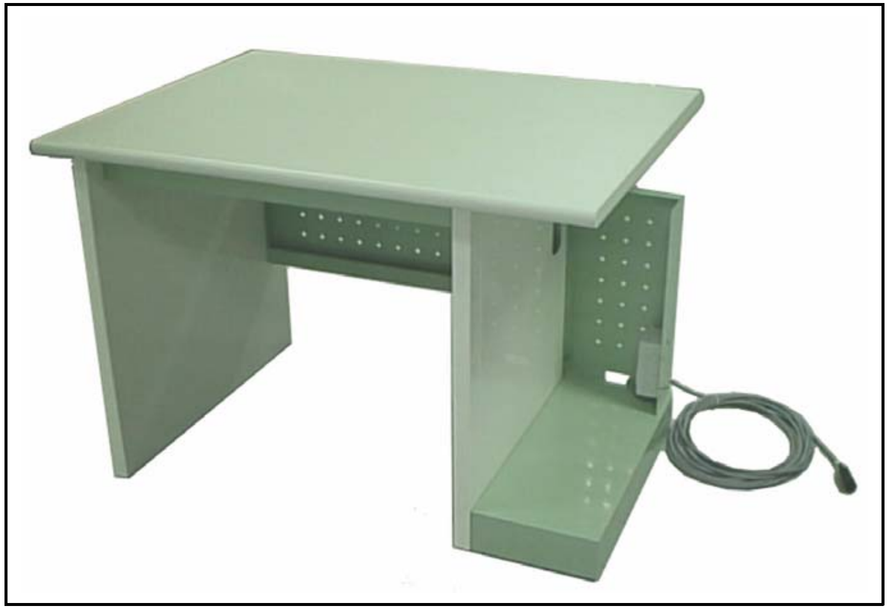


Fig. 126: Table assembled

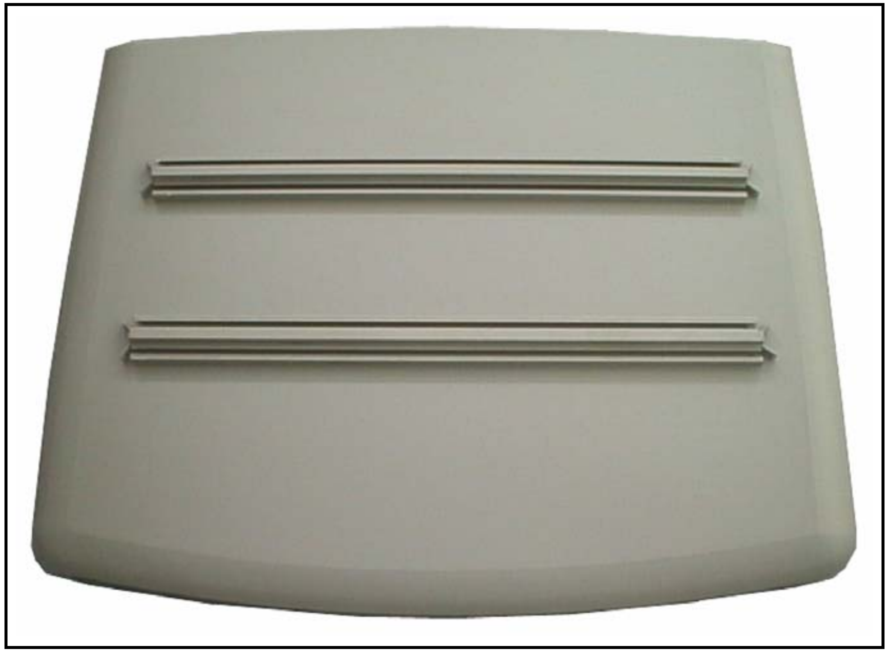


⚠**WARNING** **Multiple portable socket-outlets shall not be placed on the floor (to prevent the ingress or liquids and to prevent mechanical damage). Measures should be taken to ensure that the multiple portable socket-outlets are mounted in such a way to prevent ingress of liquids and to avoid mechanical damage during normal use and transportation**

High Version

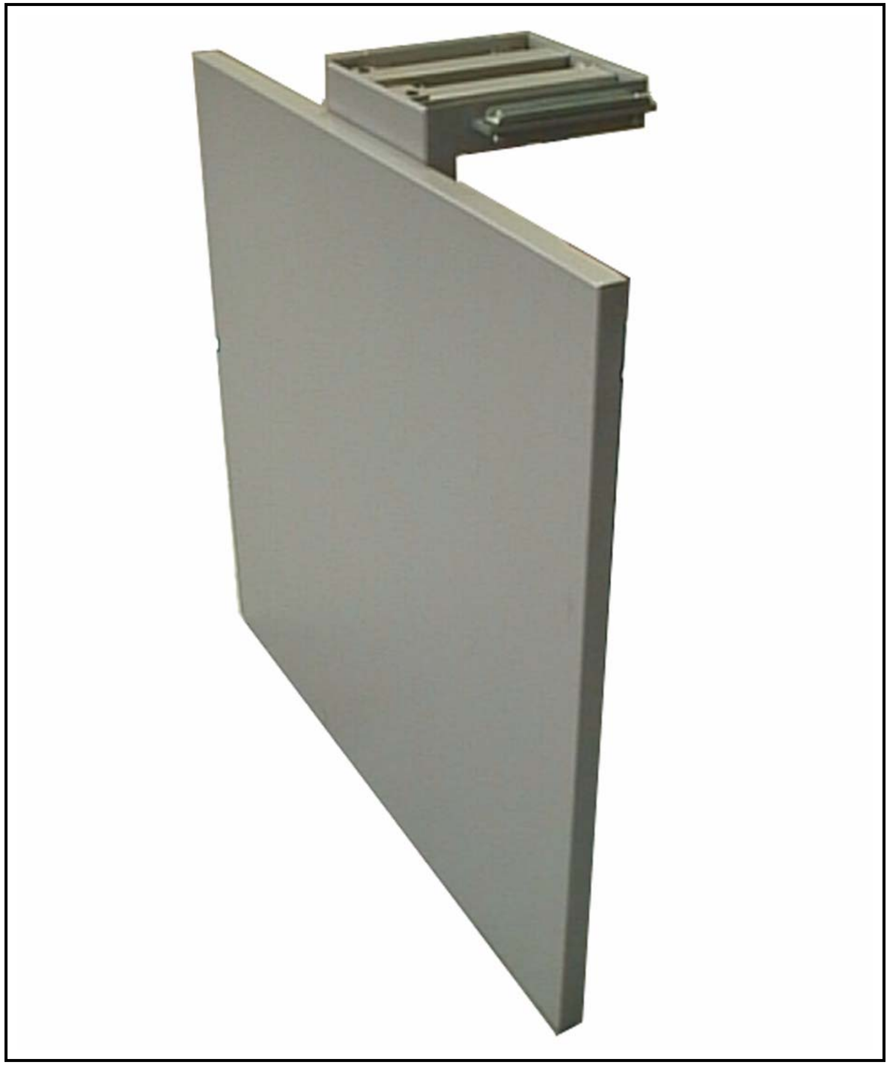
- Open all the boxes and place the three components on the floor (table, leg and leg with PC unit holder)
- Place the Table with the inferior side in upper position and open the small plastic covers placed at the end of the Table rails (like shown in the next figure)

Fig. 127: Table Inferior Side



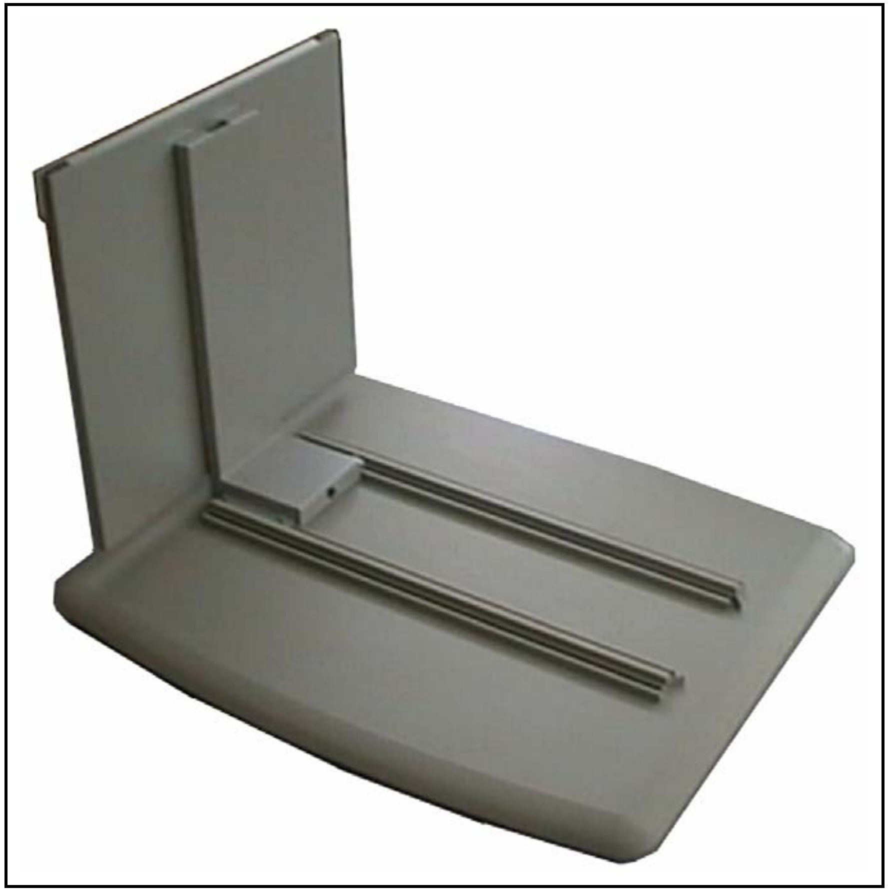
- Take the Table Leg

Fig. 128: Table Leg



- Rotate the Table Leg upside down and insert it into the Table rails then, when the Leg is in the correct position, tight the four nuts using the Wrenches provided with the kit (like shown in the next figure)

Fig. 129: Table with one Leg



- Do the same with the second Leg

Fig. 130: Leg with PC holder

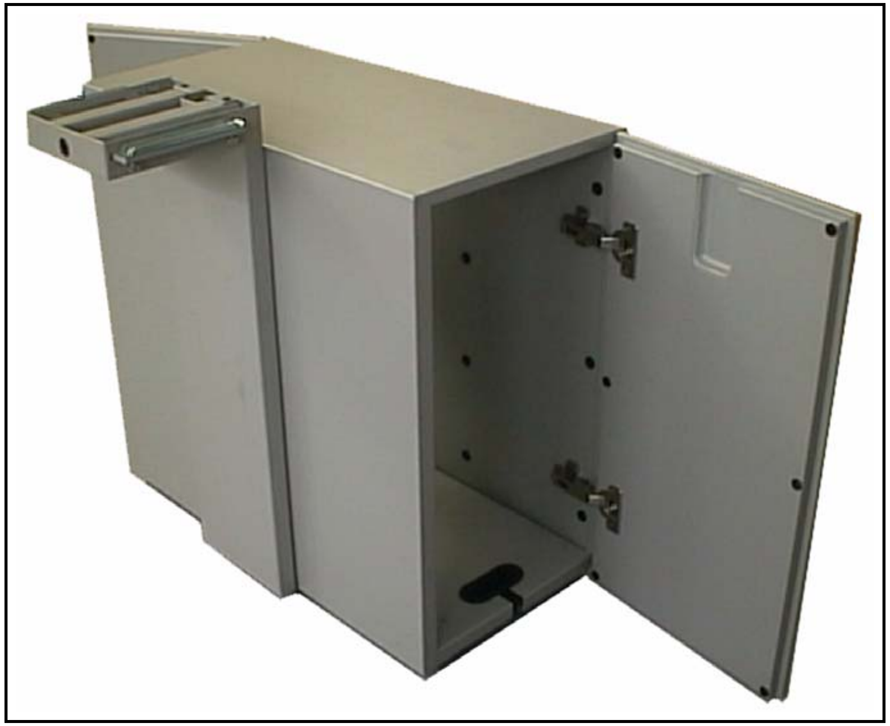
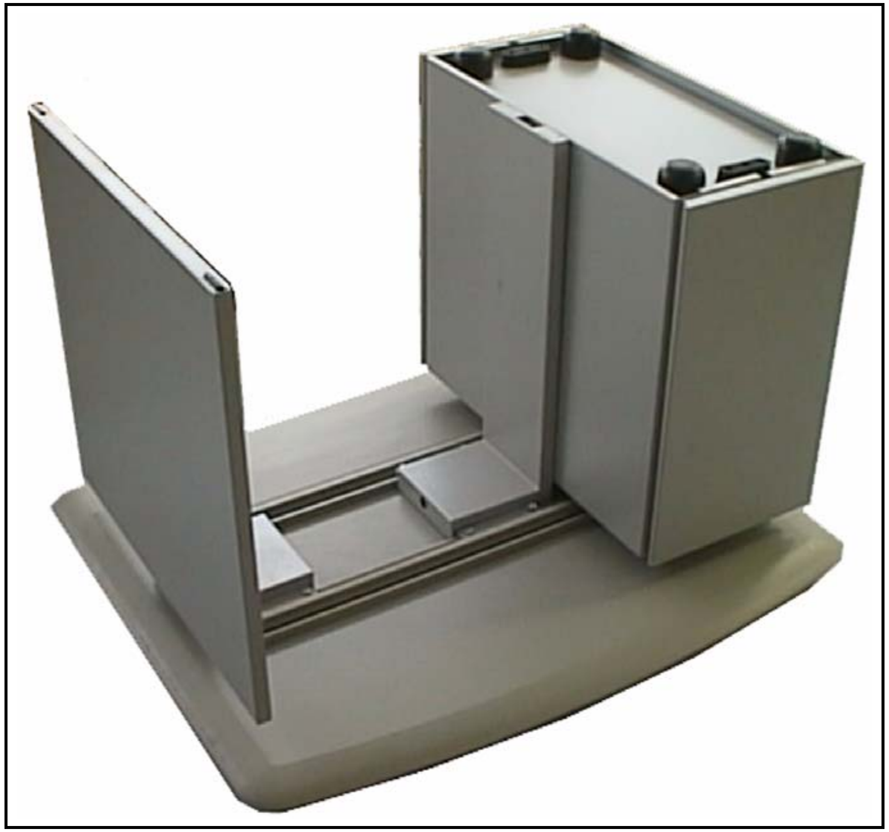
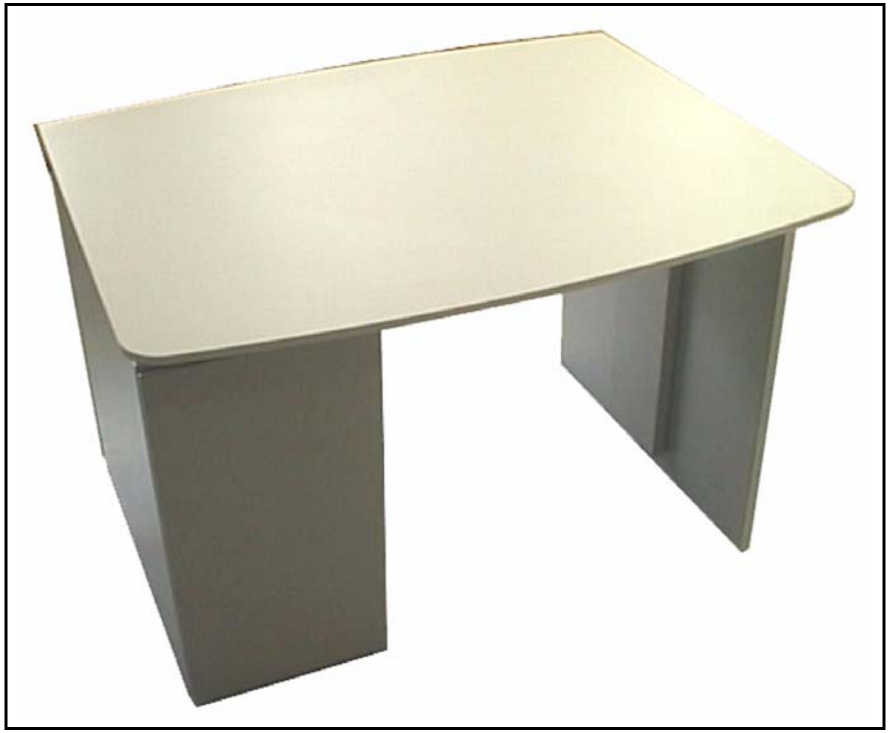


Fig. 131: Table assembled



- Adjust the Table height and rotate it upside down (like shown in the next figure) then place the PC unit inside its holder (removing the PC Holder door joints if necessary)

Fig. 132: Table assembled



⚠**WARNING** **Multiple portable socket-outlets shall not be placed on the floor (to prevent the ingress of liquids and to prevent mechanical damage). Measures should be taken to ensure that the multiple portable socket-outlets are mounted in such a way to prevent ingress of liquids and to avoid mechanical damage during normal use and transportation**

Computer Unit installation

- For Canada installation only attach the PC Unit labels in France language (contained into the installation kit) near the English labels on the computer rear side and on the power extension cord

Fig. 133: PC Unit Labels

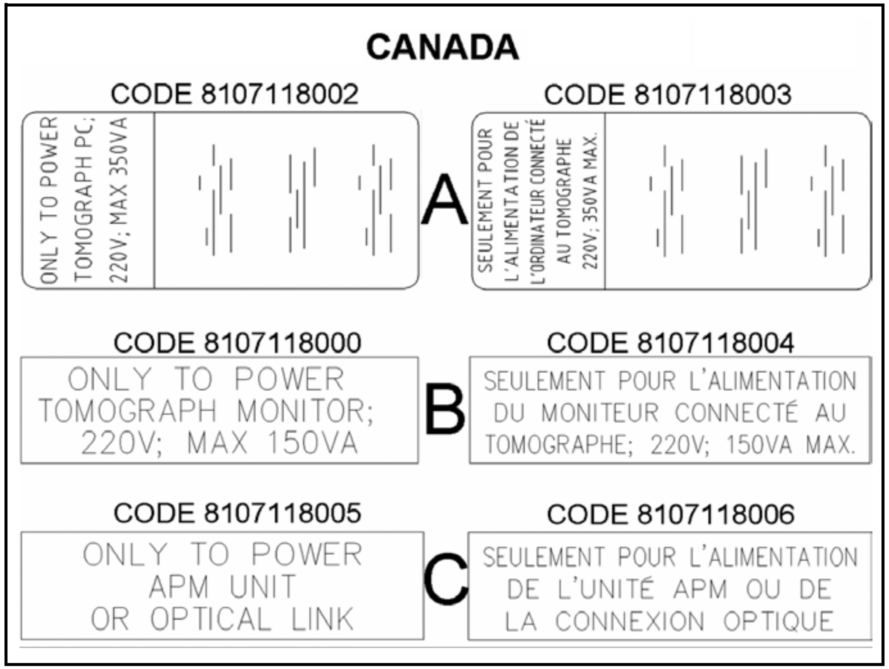
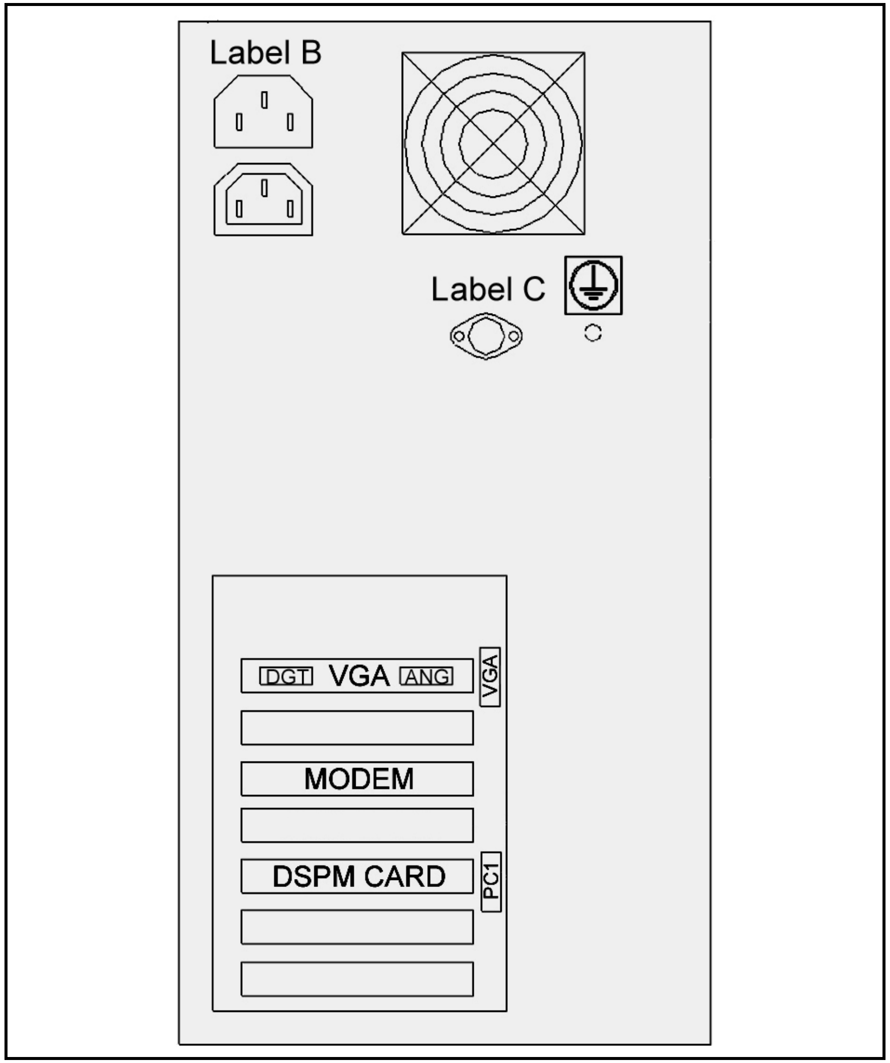

CANADA
CODE 8107118002
ONLY TO POWER TOMOGRAPH PC; 220V; MAX 350VA
CODE 8107118003
SEULEMENT POUR L'ALIMENTATION DE L'ORDINATEUR CONNECTÉ AU TOMOGRAPHE 220V; 350VA MAX.
A
CODE 8107118000
ONLY TO POWER TOMOGRAPH MONITOR; 220V; MAX 150VA
CODE 8107118004
SEULEMENT POUR L'ALIMENTATION DU MONITEUR CONNECTÉ AU TOMOGRAPHE; 220V; 150VA MAX.
B
CODE 8107118005
ONLY TO POWER APM UNIT OR OPTICAL LINK
CODE 8107118006
SEULEMENT POUR L'ALIMENTATION DE L'UNITÉ APM OU DE LA CONNEXION OPTIQUE
C

Fig. 134: PC Unit Label locations

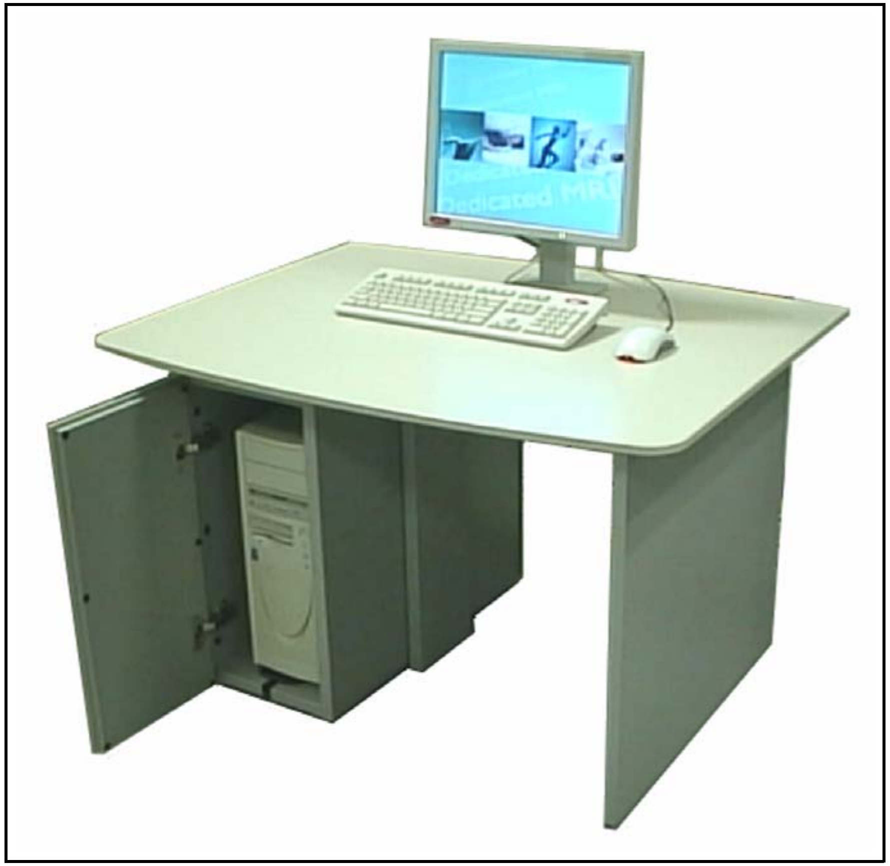


- Place the PC Unit in the appropriate pre-defined position under the User Table

NOTICE	Place the Computer Unit taking care to allow the air circulation of the fan placed on the left side of the Computer Unit Case

- Open the Monitor box and place it on the installed table and connect it to the power plug and PC Unit SVGA digital output using the provided cable
- Attach the ESAOTE label (contained in the installation kit) on the monitor manufacturer label (if not already present)

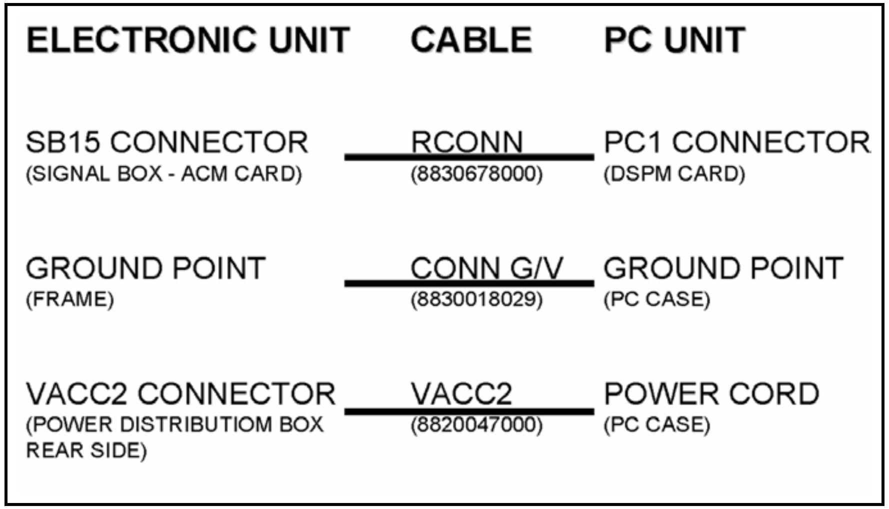
Fig. 135: System Operating Console



Cabling and Grounding

In the next figure the connections between the Electronic Unit and the PC Unit are shown

Fig. 136:



ELECTRONIC UNIT	CABLE	PC UNIT
SB15 CONNECTOR (SIGNAL BOX - ACM CARD)	RCONN (8830678000)	PC1 CONNECTOR (DSPM CARD)
GROUND POINT (FRAME)	CONN G/V (8830018029)	GROUND POINT (PC CASE)
VACC2 CONNECTOR (POWER DISTRIBUTIOM BOX REAR SIDE)	VACC2 (8820047000)	POWER CORD (PC CASE)

Ground signs indicate the ground connection points. They mean “Terminal for connection of equipment protective ground wire”

All work must be carried out in accordance with the technical documentation. Make sure that all **protective ground wires** provided by the manufacturer are connected properly before starting the equipment after installation. This applies, for example, to all metallic covers that may develop a dangerous contact voltage in case of a fault. They must always be connected to the protective ground wire. To ensure this, the connection between these covers and the protective ground wire must be made with screws and con-tact washer or via the protective ground wires provided.

The protective ground wires must be connected between the system components and the power supply as shown in the wiring diagram. In the interest of the safety of our personnel and others, the protective ground wires must be installed prior to first switching on the product/system, as well as after completing all work, before turnover to the customer, in accordance with the product documentation

- Connect the PC Unit ground point (rear case side) to the Electronic Unit ground point (on the left or right frame) passing the ground cable through the Wave Guide. Use the 16 mm^2 yellow-green wire supplied with the system
- Connect the Magnet Unit ground point (Magnet basement rear side) to the Electronic Unit ground point (on the Filter Panel). Use the 16 mm^2 yellow-green wire supplied with the system

⚠**WARNING** **DO NOT USE AN EXTRA CABLE TO CONNECT THE PAVILION TO THE MAIN GROUND TO AVOID GROUNDING LOOP**

Refer to the following figures for the System cabling and grounding points (indicated by arrows).

Fig. 137: System Cabling and Grounding Connections

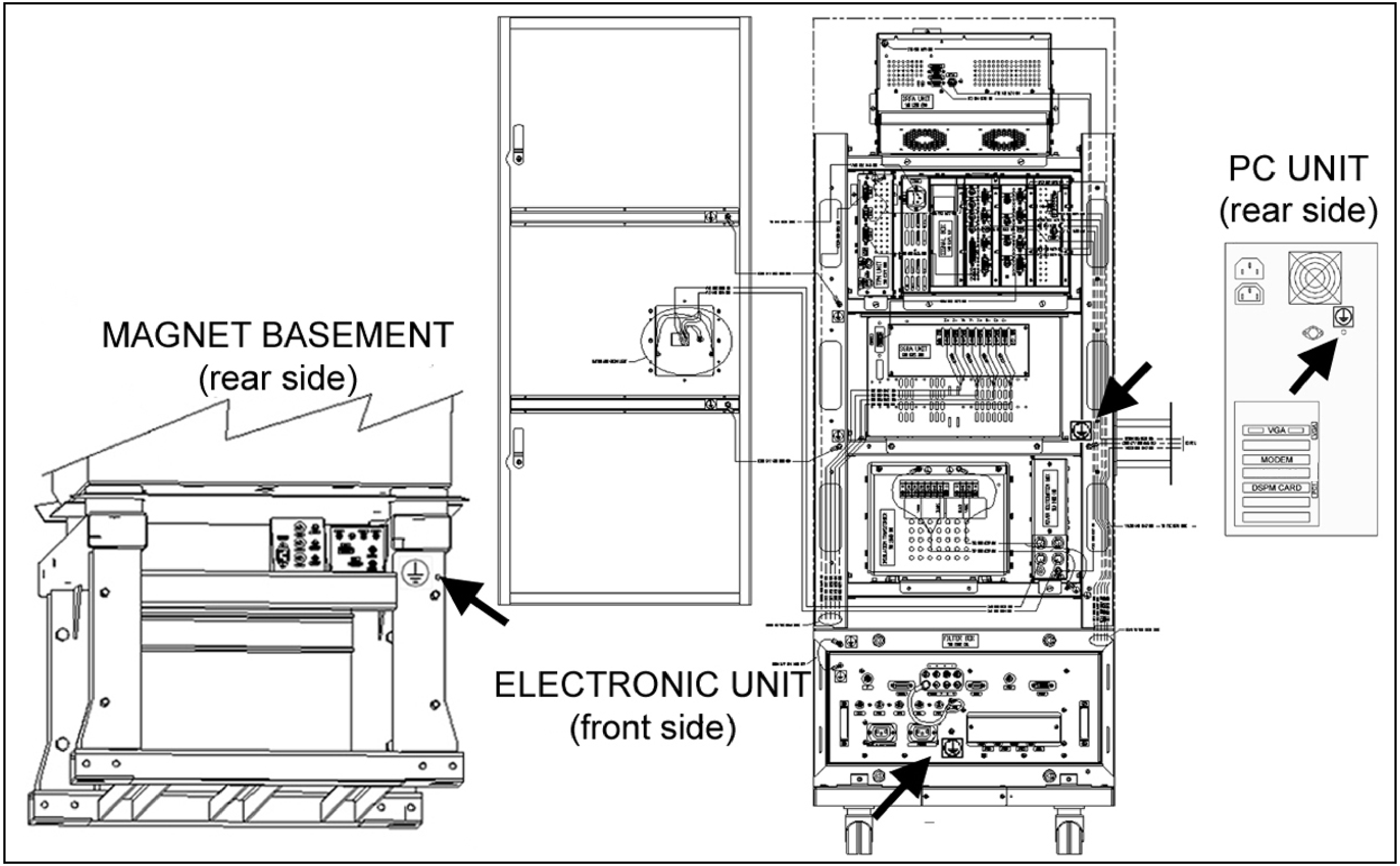


Fig. 138: Electronic Unit Door (rear side)

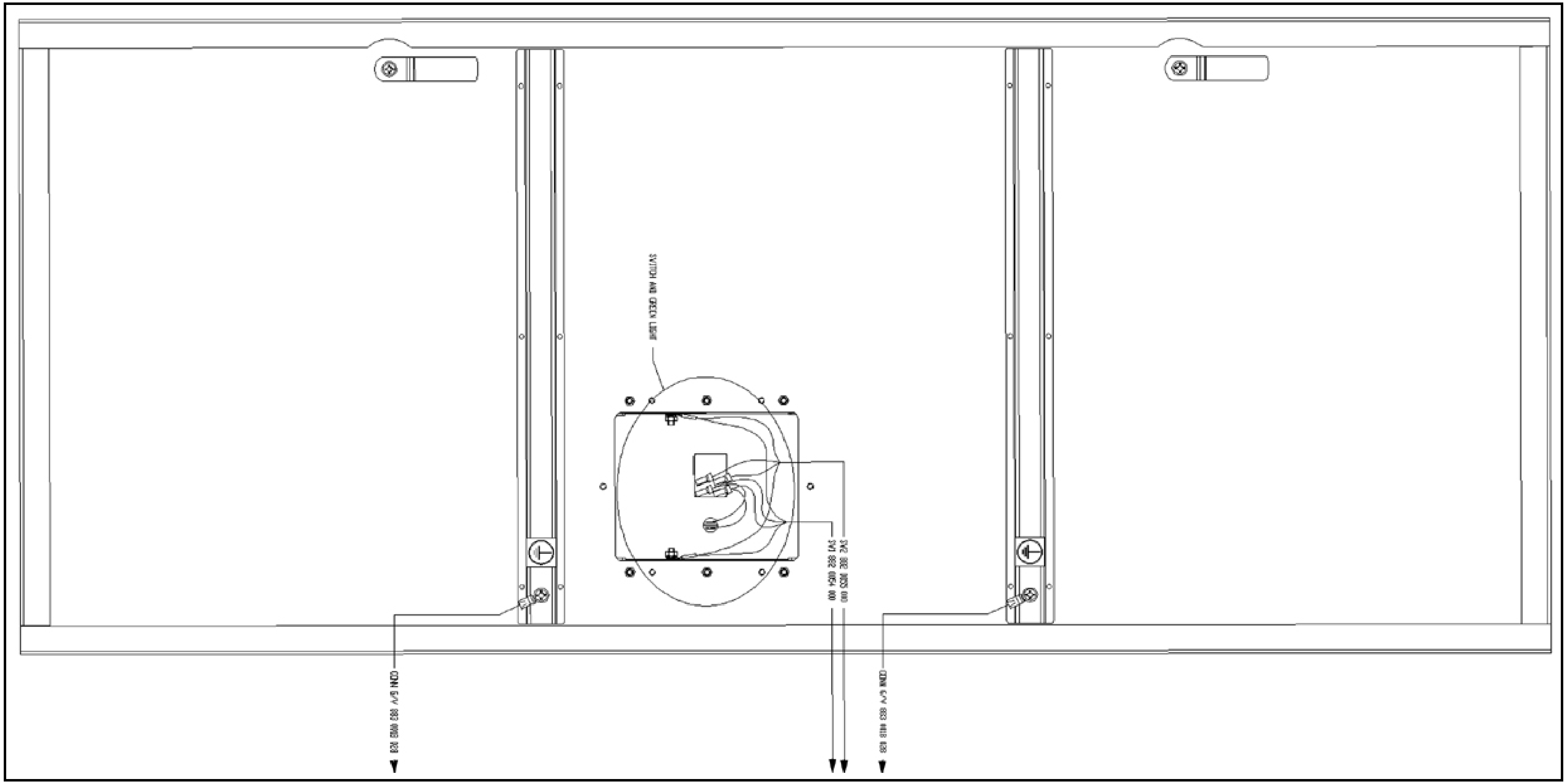


Fig. 139: Electronic Unit front side

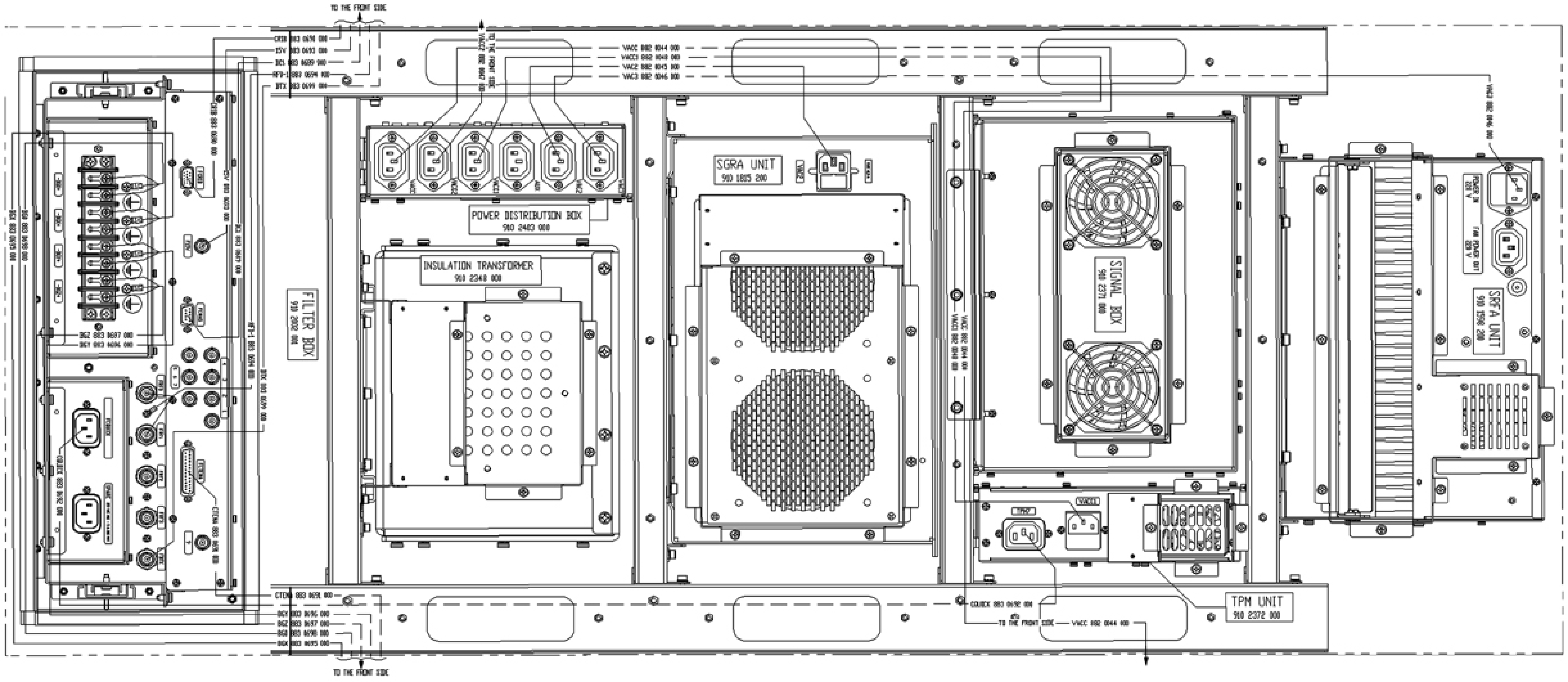


Fig. 140: Electronic Unit rear side

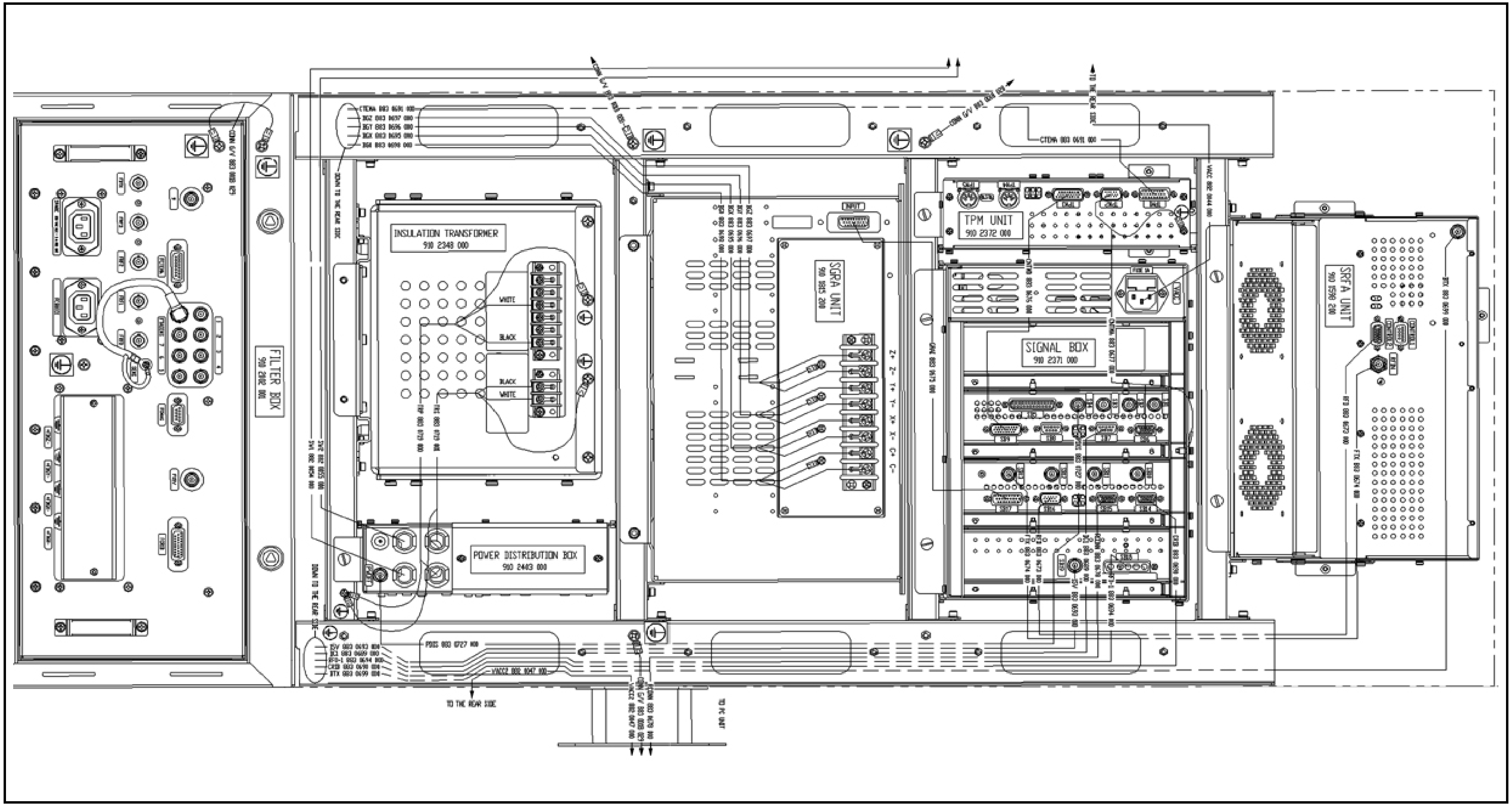
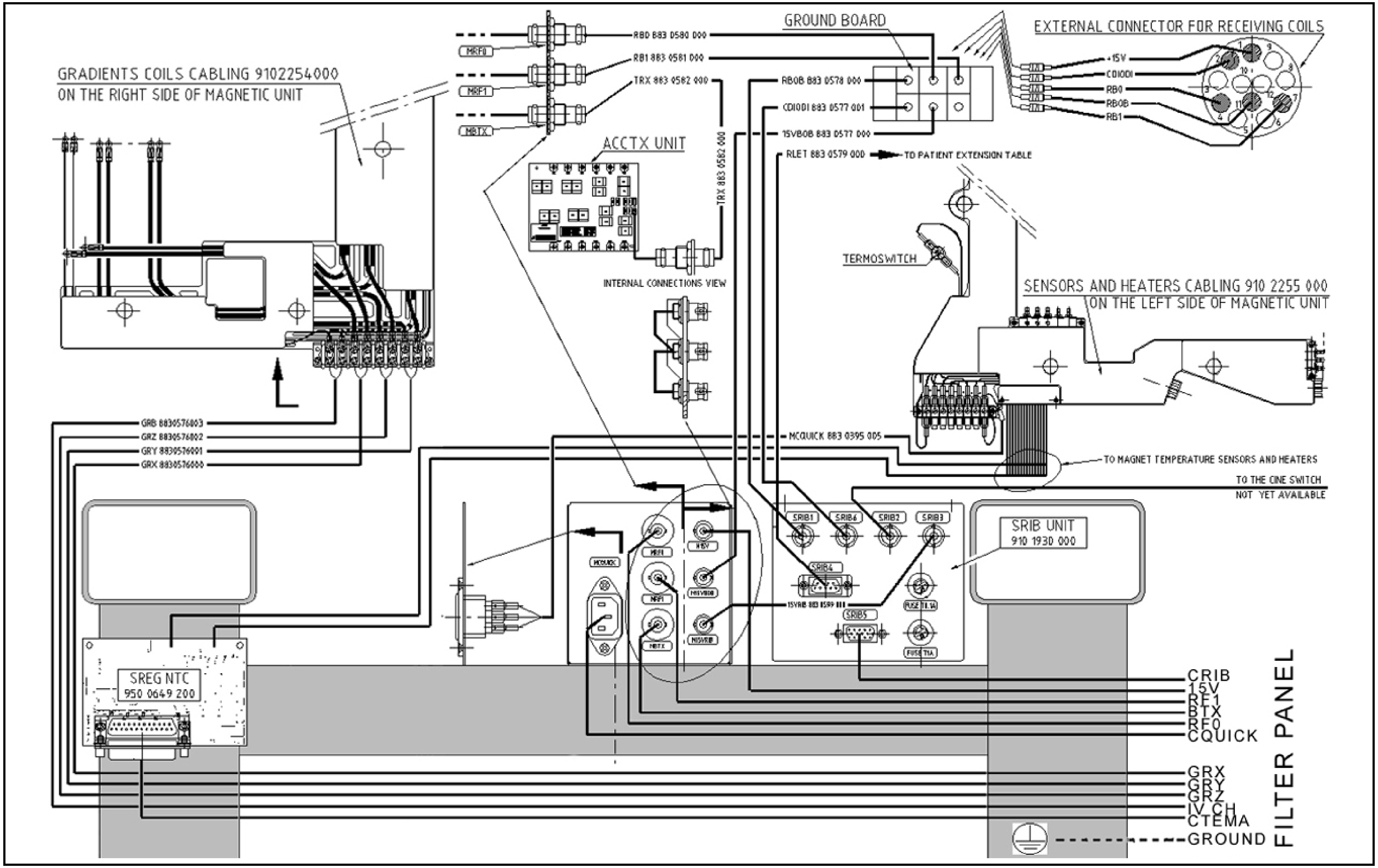


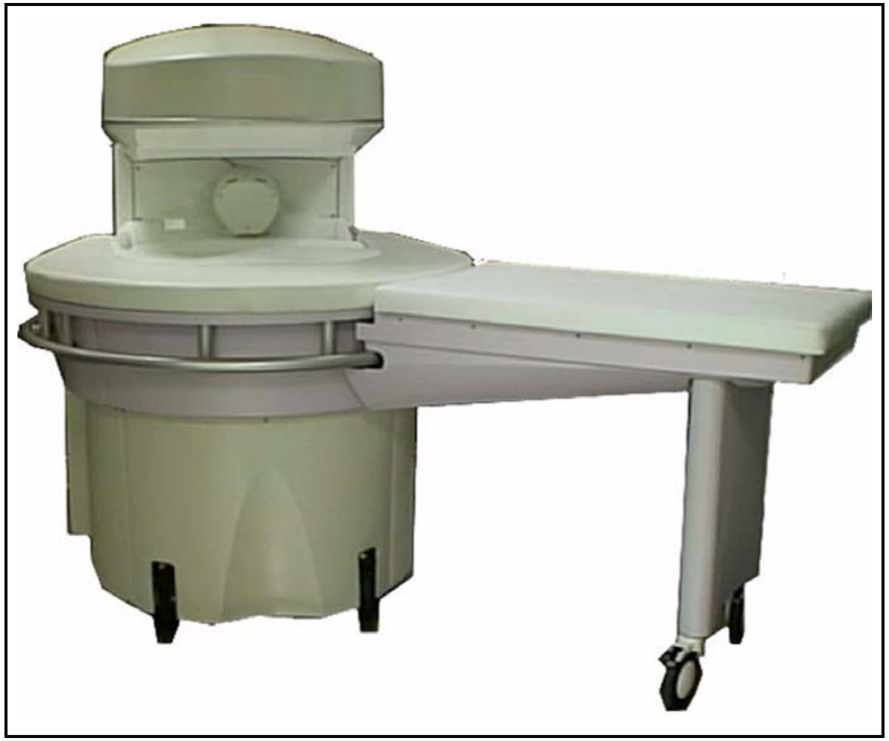
Fig. 141: Magnet Rear Connection Panel and Cabling



Magnet accessories and cover assembly

Once the covers have been assembled the System will appear as shown in the following figure.

Fig. 142: Covers assembled

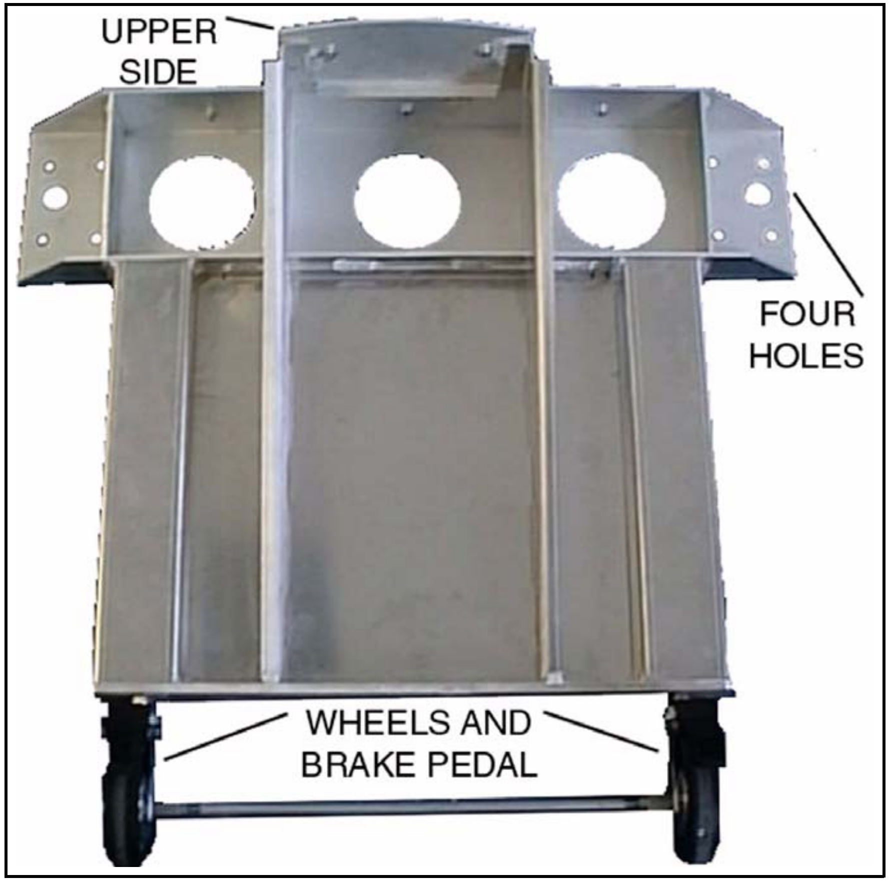


Wheeled structure installation

The first operation is to fix the wheeled structure to the magnet structure. The wheeled structure is shown in the following figure.

Five holes in the top make it possible to fix the wheeled structure to the round table. The wheeled structure is attached to the magnet brackets by the four holes on each side.

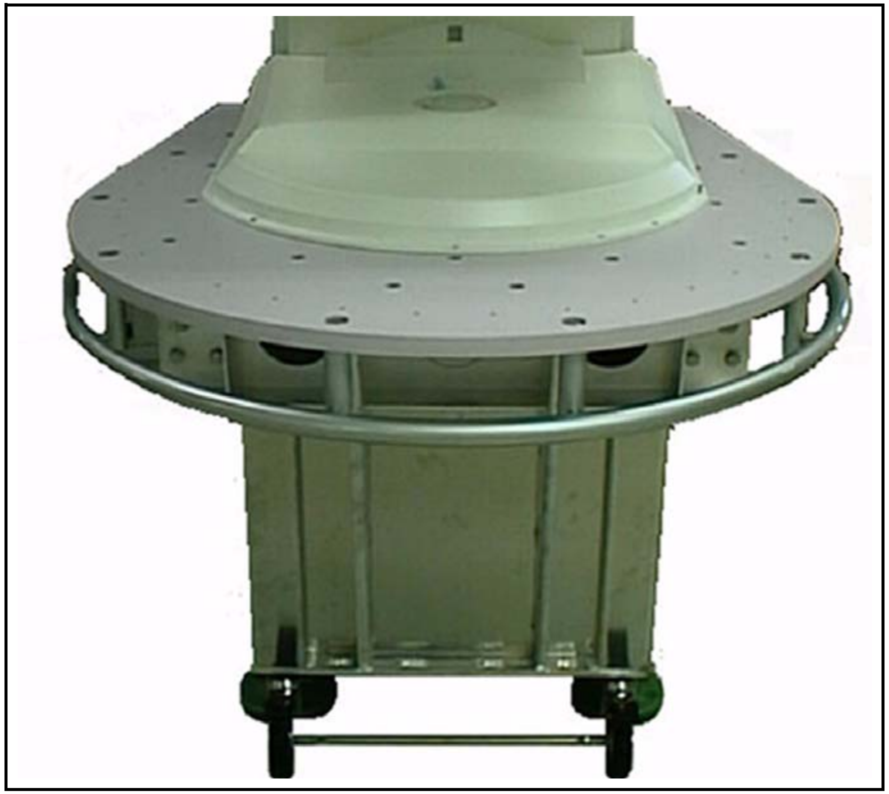
Fig. 143: Wheeled structure



Using the bolts (four per side) already mounted on the magnet brackets, fix the wheeled structure to the two sides of the magnet structure (see the following figures) and using the screws (five) (code 0600000199) fix it to the round part of the magnet.

⚠**WARNING** **DO NOT PULL OUT THE ROUND PART OF THE MAGNET STRUCTURE BEFORE THE WHEELED STRUCTURE IS INSTALLED**

Fig. 144: Wheeled structure installation

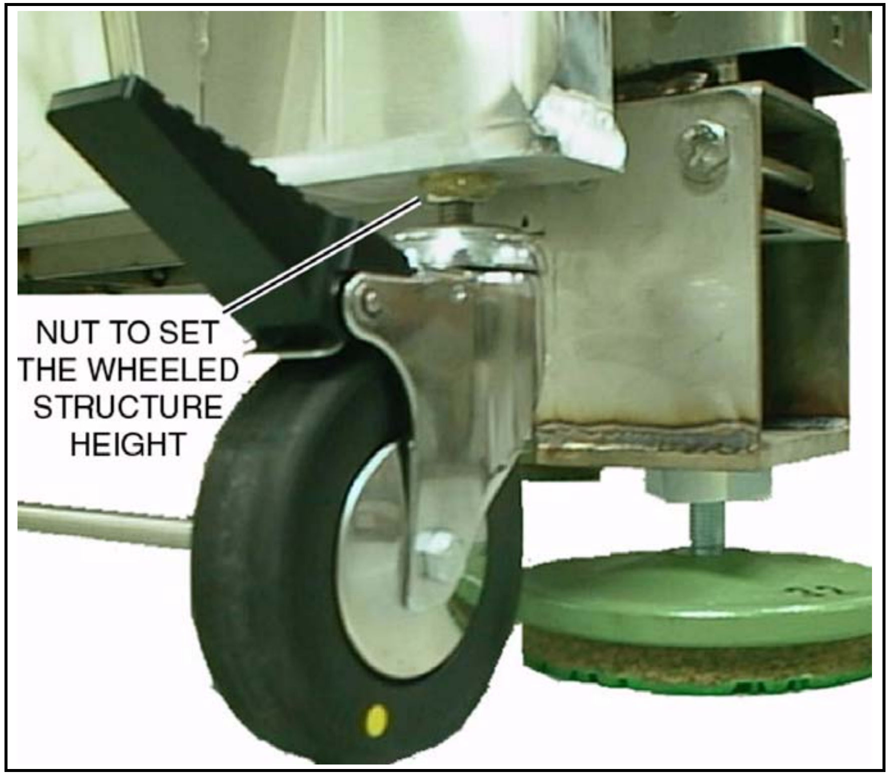


Now, using the round bar, you can pull out the round part of the patient bad.

Test if you can pull the bed right out and if the wheels touch the floor during the movement.

Otherwise you can adjust the height of the wheeled structure by turning the nuts already mounted on the wheel pivots, as shown in the following figure.

Fig. 145: Wheel pivot nut position



Patient bed Installation

Install the patient bed on the round bar already mounted on the magnet structure. During installation, hold the handle of the bed in order to connect the bed lock mechanism to the round bar.

Remove the Patient Bed Handle and the Patient Bed Cover to install the Patient Bed.

Fig. 146: Handle installation

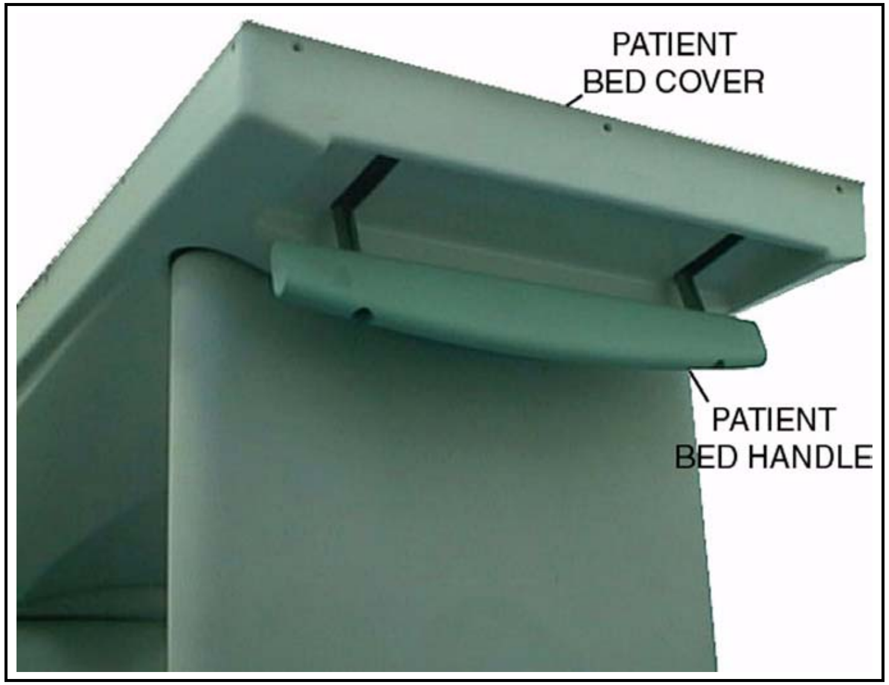
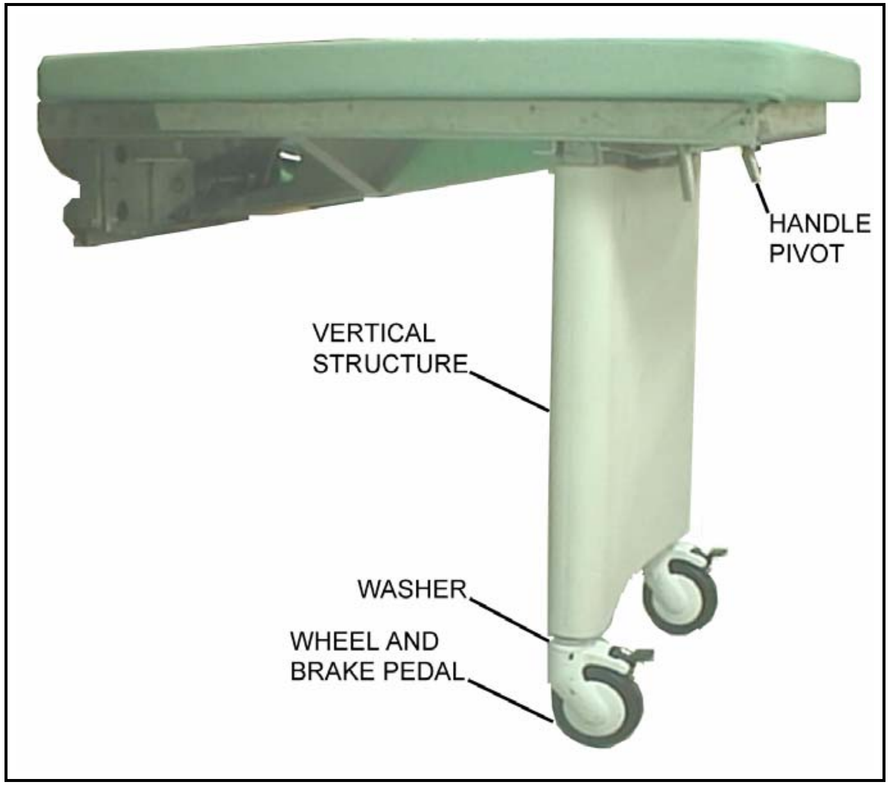


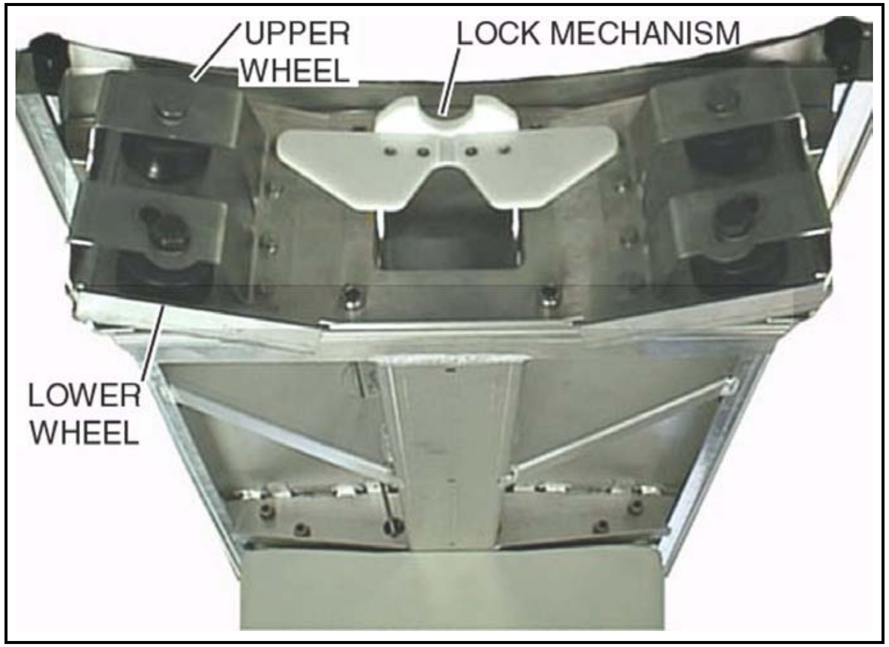
Fig. 147: Patient bed



The lower wheels are mounted using a nut: put the lower wheels in the lower position, screwing the wheels nut.

Keeping the lock mechanism in the upper position, place the round bar between the two upper and two lower wheels, and lock the patient bed to the round bar.

Fig. 148: Patient bed lock mechanism



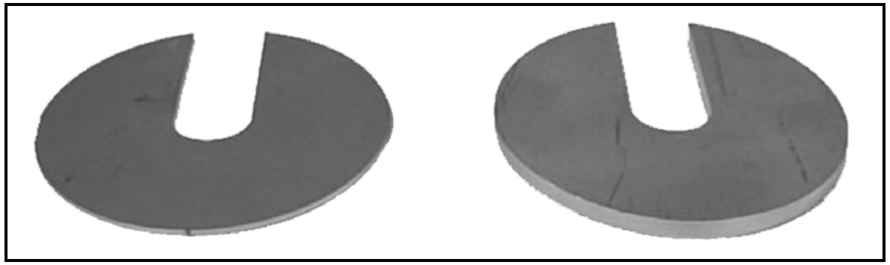
Now keep the lower wheels in the highest position and fix the wheel nuts, one per wheel.

In the above figure you can see the lock mechanism in white: the handle in the opposite position to the patient bed moves it.

The patient bed wheels have brakes. Adjust the patient bed height and level it putting special washers (code 8105688000 and 8105688100), with different thickness, on the wheel pivots between the wheels and the vertical structure of the patient bed.

The special washers are shown in the following figure. See the previous figures for the washer installation position.

Fig. 149: Patient bed washers with different thickness



Now check if you can move the patient bed in all possible positions, try to pull it out and push it in, check the patient bed level and stability, see if the bed can be moved easily and if all the mechanical mechanisms work properly.

It is very important to check the movement of the magnet brackets: check if they slide on the magnet wheels in the correct way.

See the correct movement in the following two pictures.

Fig. 150: Look the magnet brackets movement

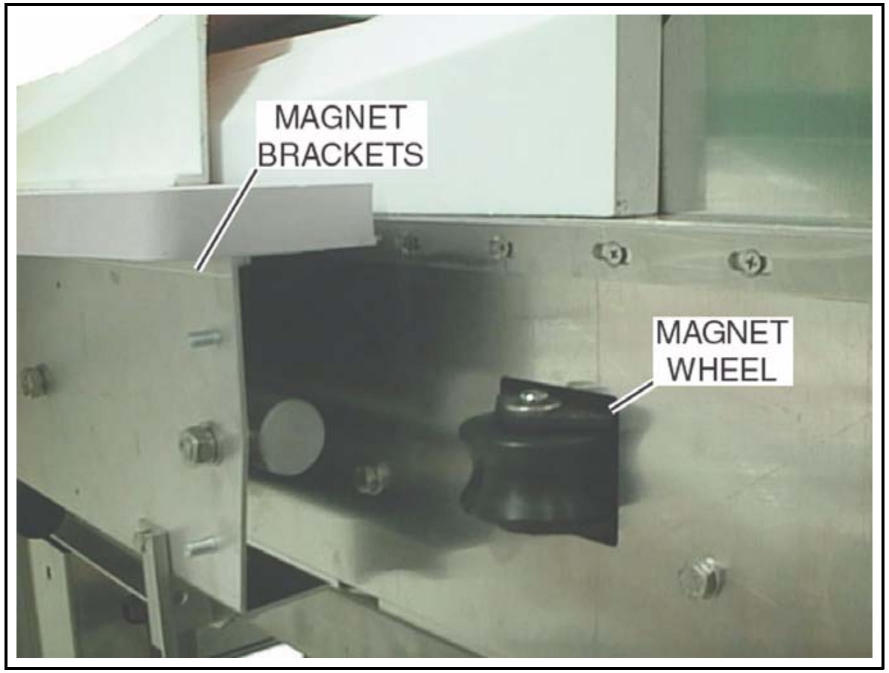
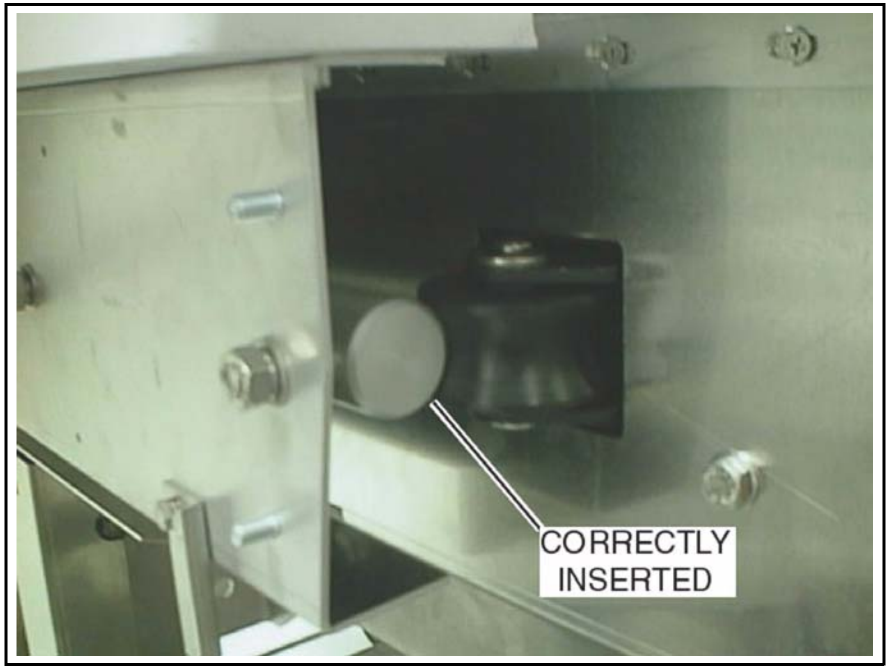


Fig. 151: The patient bed is working properly



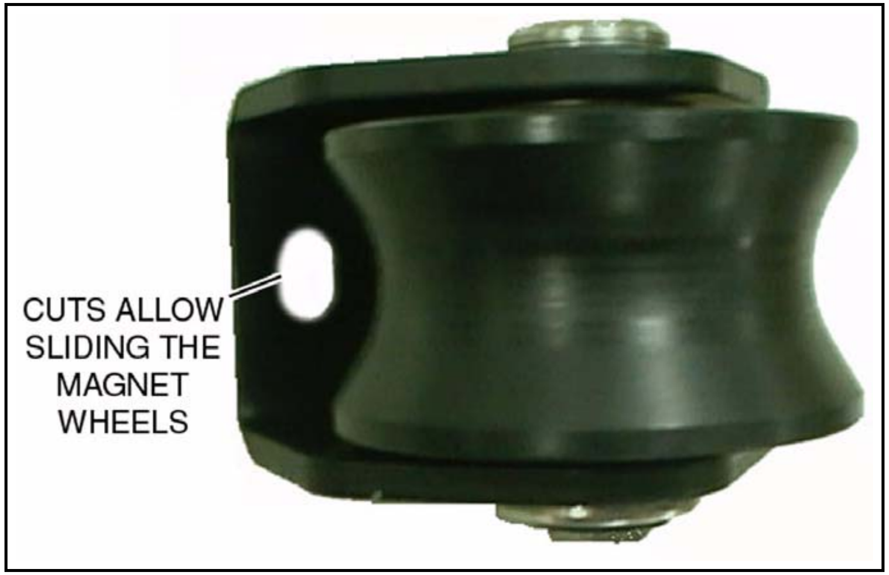
As in the following figure the magnet bracket must be perfectly inserted in the magnet wheel.

If the patient bed or the magnet wheels are not at the correct height you can adjust it. See above how to adjust the patient bed height.

The magnet wheels can be removed. Take out the two bolts per wheel and insert the rectangular piece (code 8105066000), if you need to increase the distance between the wheel and the magnet, or move the wheel up or down if you want to increase or decrease the wheel height.

The two wheel bolts are inserted in long slots and not in the circular holes. See the following picture showing the magnet wheel structure.

Fig. 152: Magnet wheels structure



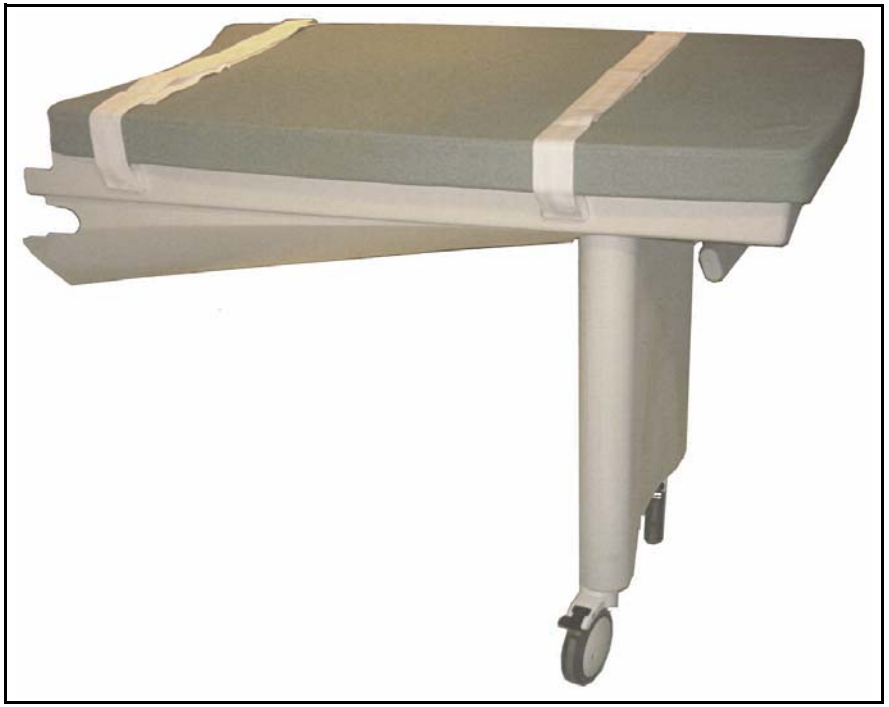
Patient Belt Kit installation

It must be installed to guarantee patient safety.

The belt component has been optimized to be as user friendly as possible so resulting in a safer patient's positioning during the examination procedure. The engineering of belts for patient safety is aimed at guaranteeing patient comfort and stable positioning for patients in problematic health conditions.

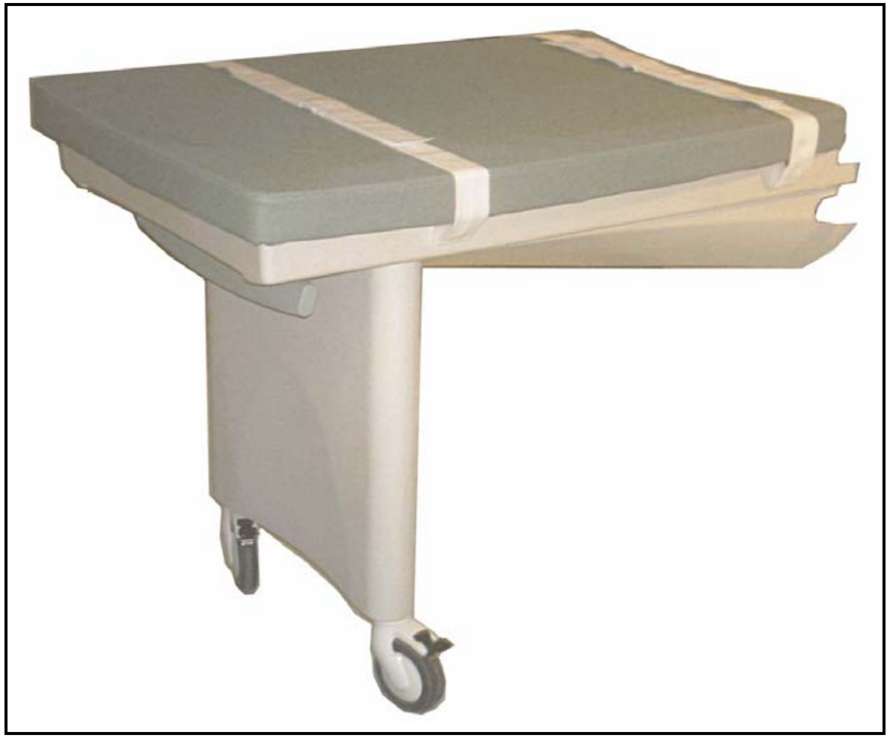
- Remove the two screws form the left side of the bed cover
- In their locations place the round head bolts provided with the kit
- Join the plastic pieces to the inserted bolts

Fig. 153: Patient Belt composition



- Repeat the previous steps on the right side of the bed patient cover

Fig. 154: Patient Belt installed

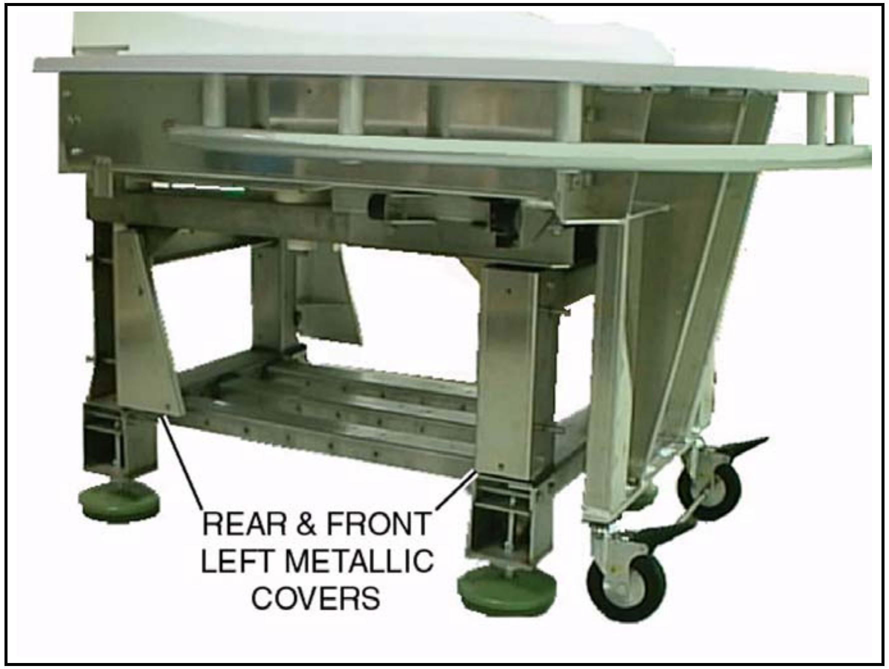


Magnet Cover Assembling

Pull out the patient bed and fix the right and left front metallic covers to the magnet base, using the screws.

The left and right rear metallic covers are already installed.

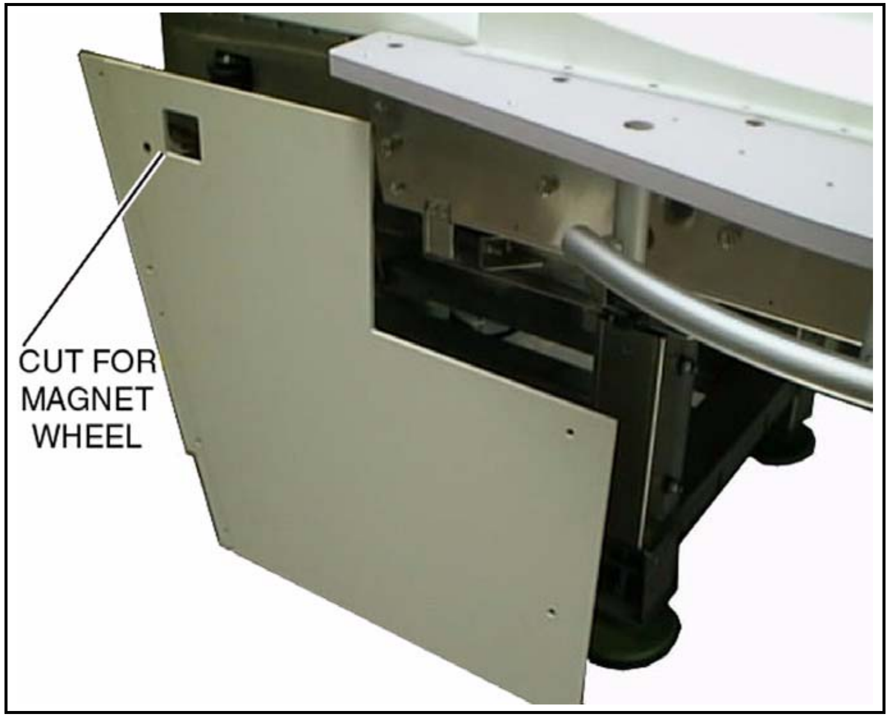
Fig. 155: Front and rear left metallic covers



Holes have been made on the metallic covers: use them to fix the left and right plastic covers with the screws.

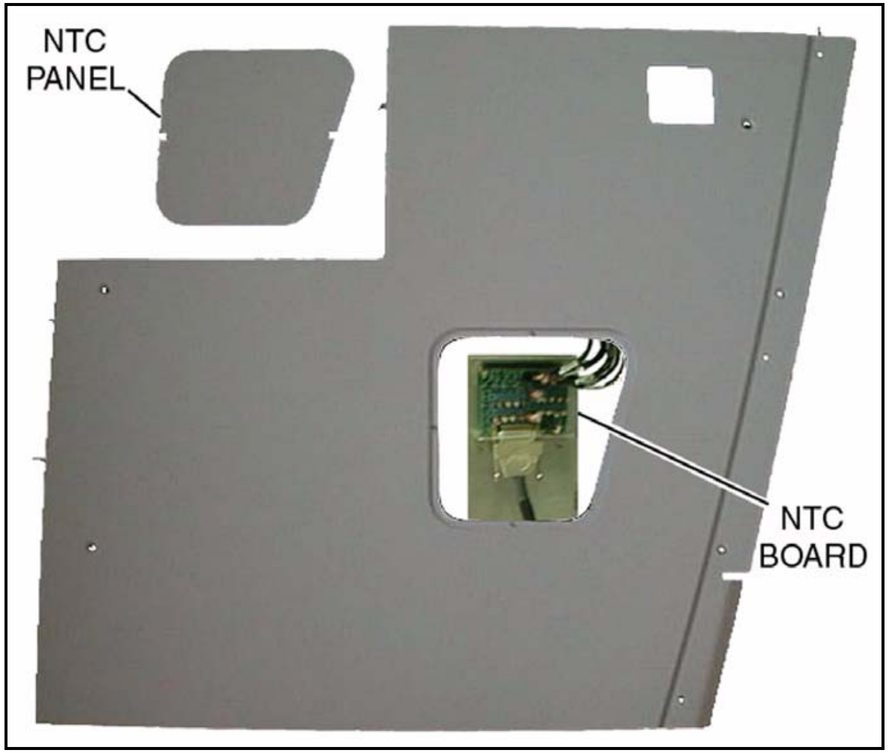
In the following figure the Left Cover assembling is shown.

Fig. 156: Left cover



The right cover has one small central panel so that you can check the NTC board.

Fig. 157: Right cover with opened panel



Move the patient bed to the left or right side and install the central upper cover placing it between the round bar and the wheeled structure.

Holes have been made along its upper edge to fix the cover to the round part of the patient bed. The above-mentioned cover is shown in the following figure.

Following the same procedure install the right and left upper side covers to the round part of the patient bed.

Fig. 158: Central upper cover position

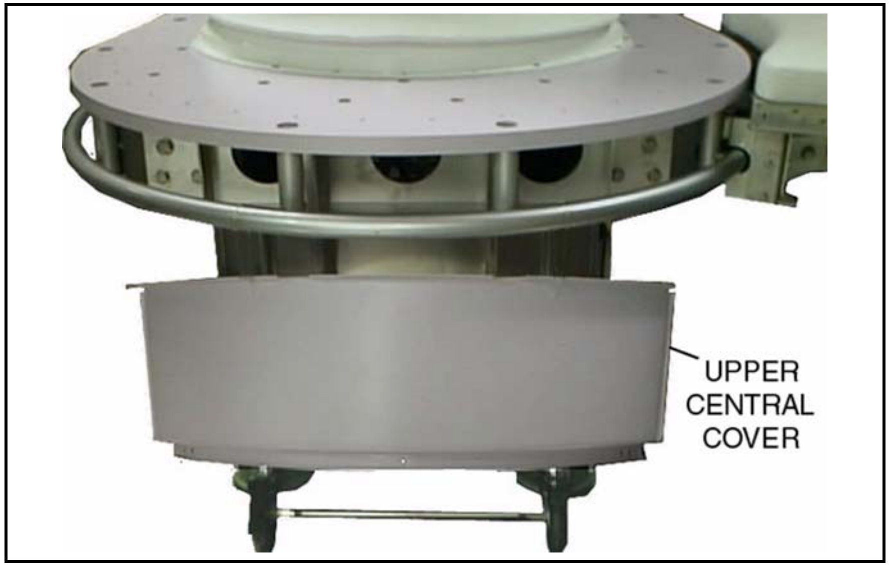
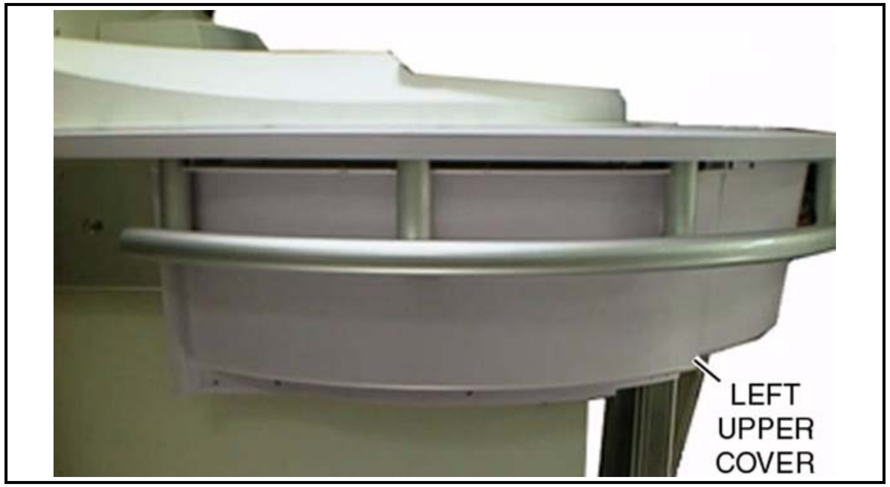


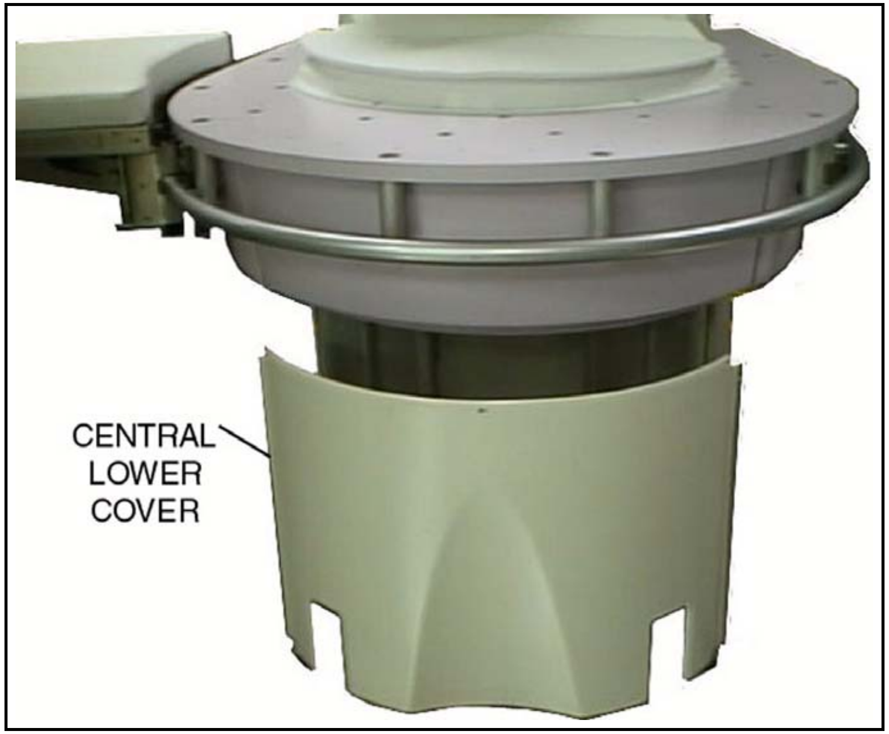
Fig. 159: Left upper cover



Now install the central lower cover. It must be fixed after the central upper cover installation.

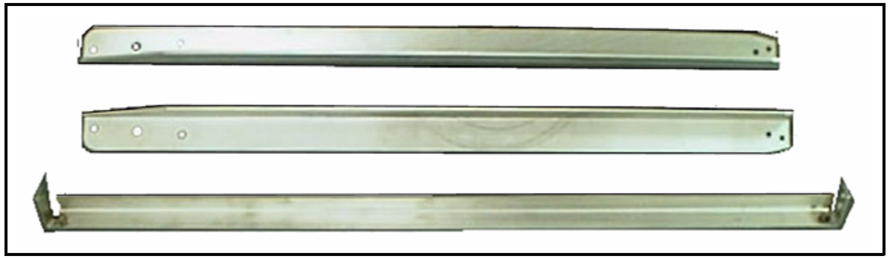
The above mentioned cover is shown in the following figure.

Fig. 160: Lower central cover



Now fix the right and left vertical bars to the magnet brackets using two screws and one nut already mounted on the magnet brackets. As shown in the following figures.

Fig. 161: From the top the right, left vertical and horizontal bars



Assemble the horizontal bar to the vertical bars, using two bolts, two washers and two nuts per side, as shown in the following figures.

Fig. 162: Horizontal and right vertical bar assembled together

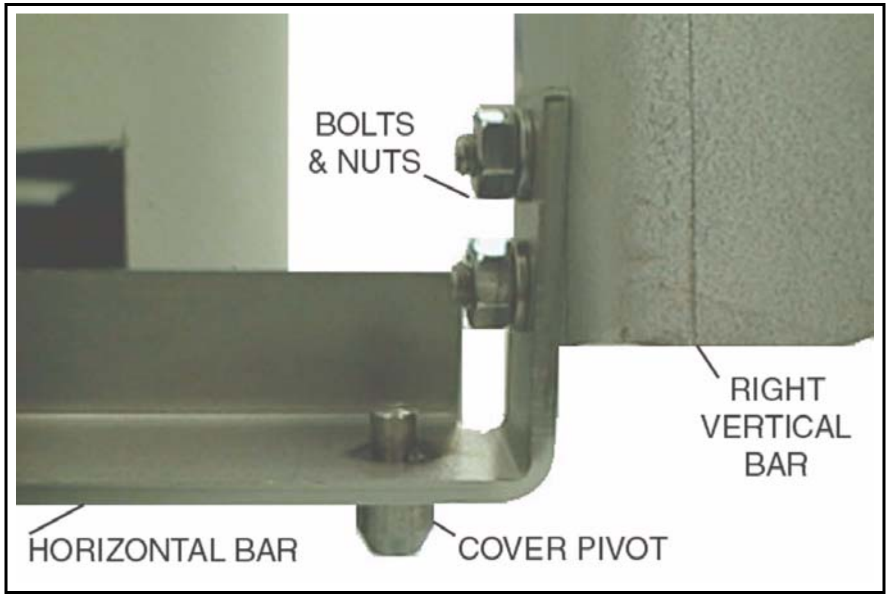
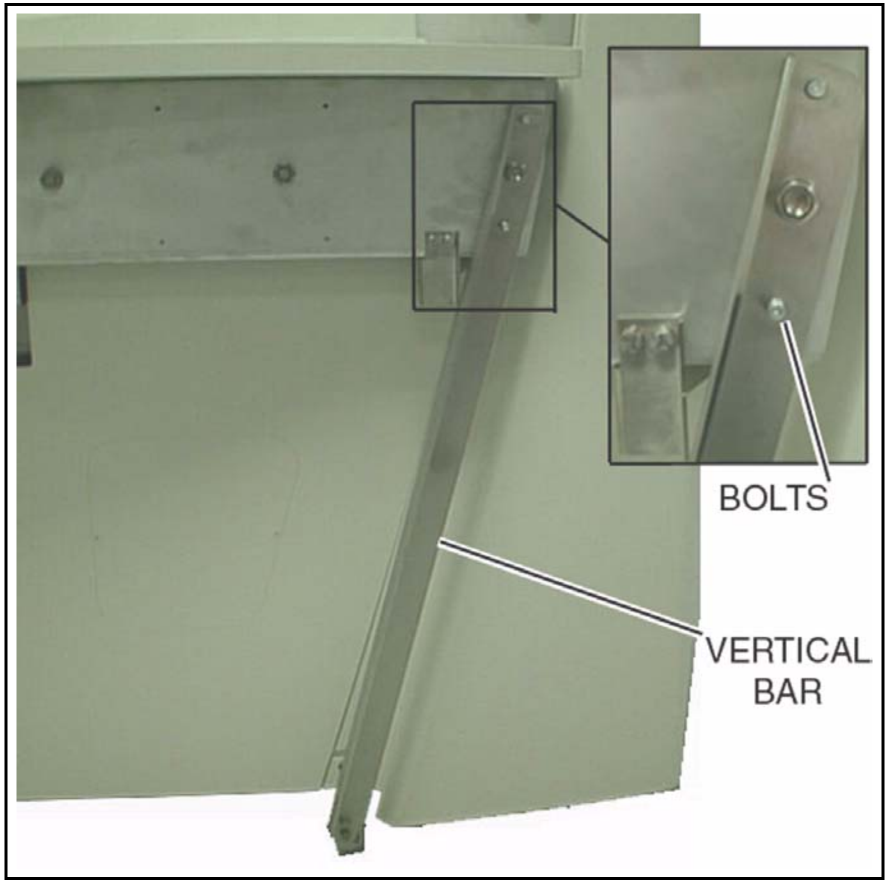
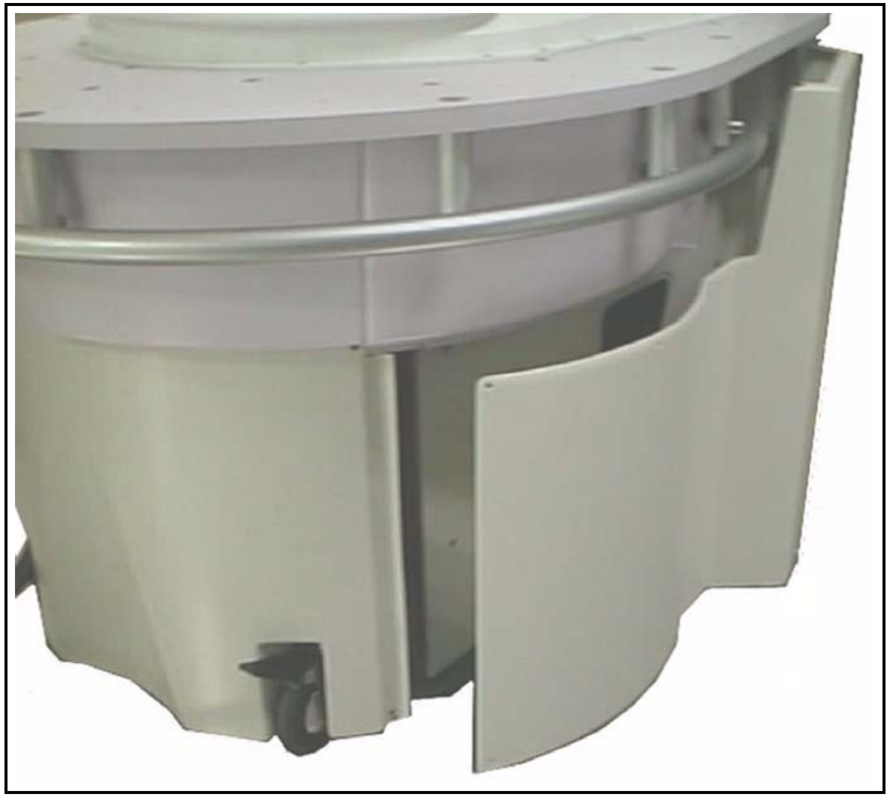


Fig. 163: Right vertical bar fixed to the magnet brackets



To place the right or left lower covers, first insert the above-mentioned cover pivot on the horizontal bar in its corresponding hole on the cover; then fix it to the central lower cover and to the right or left upper cover and to the round table.

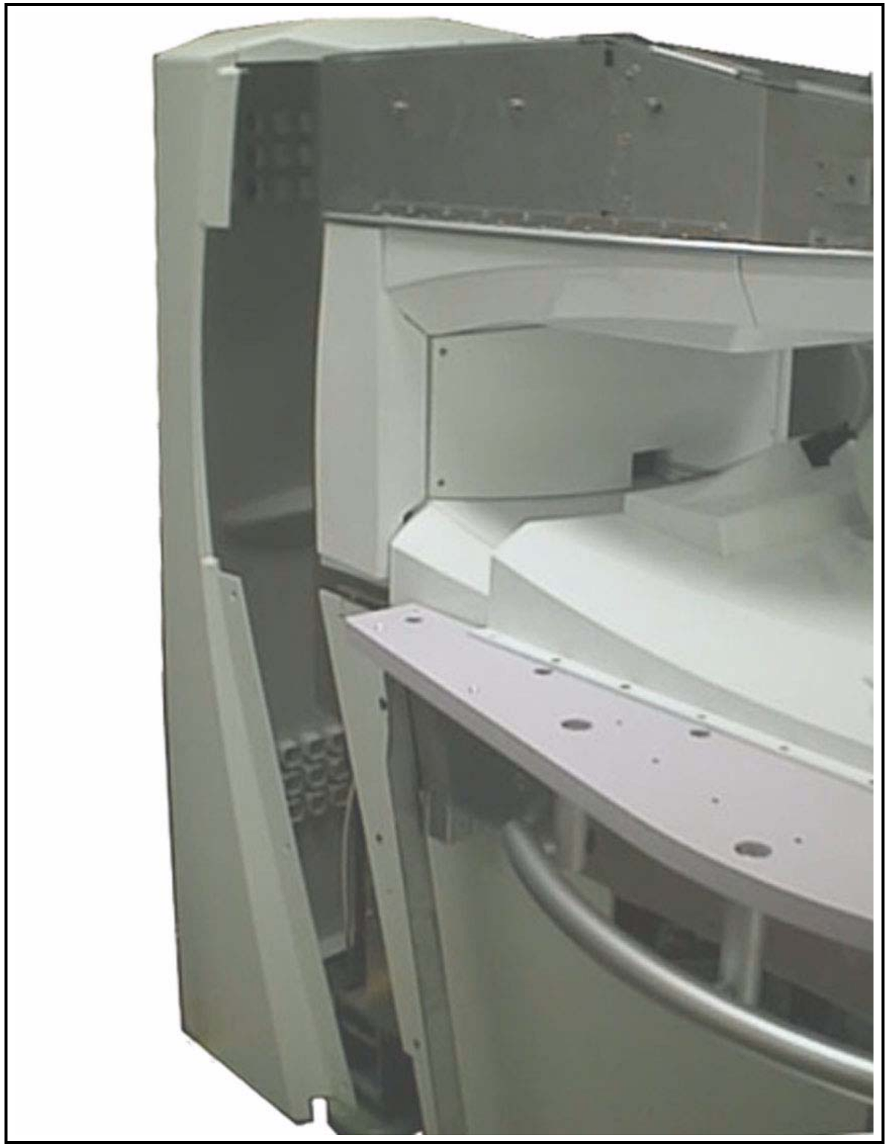
Fig. 164: Right lower cover assembly



Pull out the patient bed and then place the rear Magnet cover.

Join it to the Magnet lateral covers with the suitable screws along its the lower edges.

Fig. 165: Rear cover installation

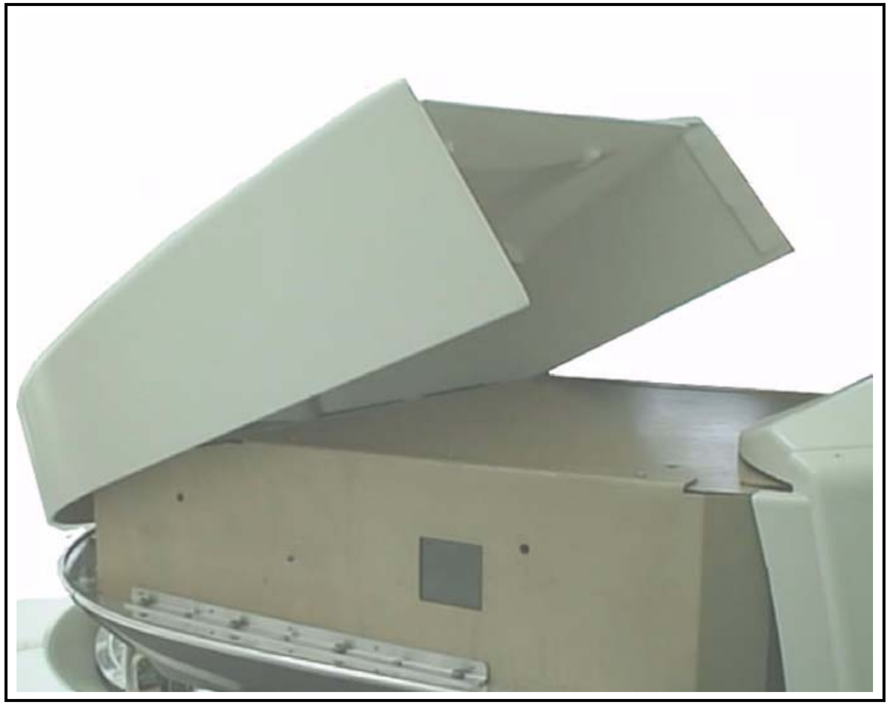


Place the Magnet top cover as shown in the next figure.

Slide the rear part under the Magnet rear cover.

The Magnet top cover is kept in correct position by velcro stripes present on the Magnet top metallic cover (front side).

Fig. 166: Roof cover installation



The procedure is over.

Part 4 Start Up

Prior to switching on

Checking the line voltage

- Lock all emergency shutdown buttons
  - Prior to switch-on, several adaptations to the line voltage must be made
- Ask your project manager about the on-site line voltage and perform your own measurement

The on-site line voltage is:	**V AC**

NOTICE Switch off the on-site power supply and secure it with a lock to prevent anyone from inadvertently switching it on

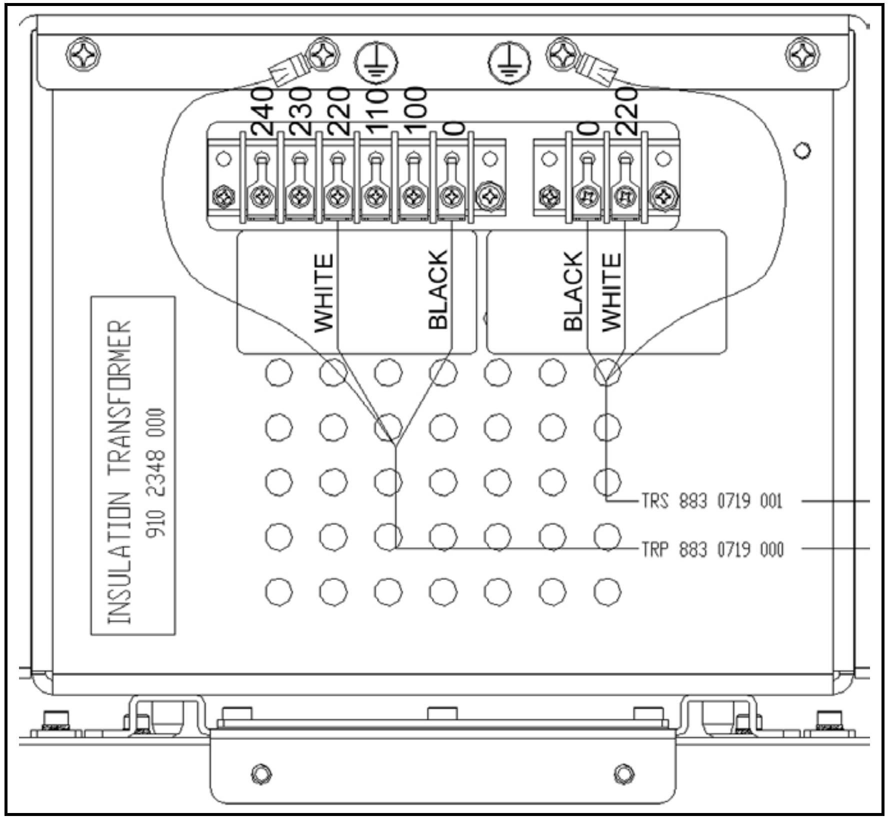
Adapting transformer to the line voltage

- Check if the primary stage of the insulation transformer is correctly set for the main supply voltage of the country where the System is installed. Refer to the figure for transformer settings
- Use the cables supplied for the additional bridge if necessary. The insulation transformer is inside the Electronic Box under the GRA module. In the next figures the possible settings and the Insulating Transformer are shown

⚠**WARNING** **In the factory the System is set to 220 V AC with the corresponding fuse**

The secondary voltage is set in factory and must be set at 220 V

Fig. 167: Possible transformer input voltage



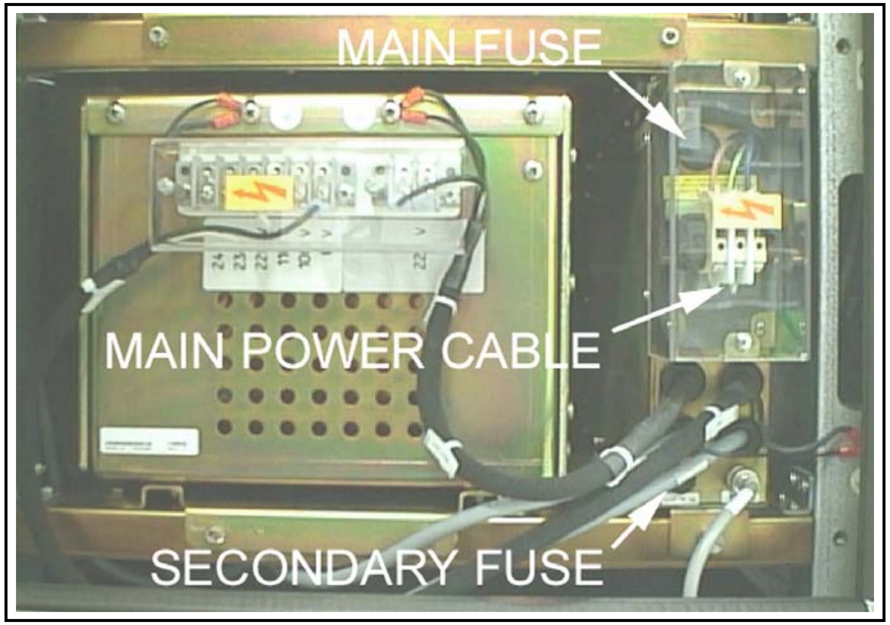
- Now insert the correct main fuse and place the appropriate fuse-label close to the main fuse position.

  – Fuse 15 A for 100 ÷ 110 V AC supply voltage, Ch T

  – Fuse 6.3 A for 220 ÷ 240 V AC supply voltage, Ch T

CAUTION **In case of 15 A fuse use, the fuse cap must be changed with the provided one due to the different fuse length**

Fig. 168: Insulating System transformer and Main Power Connection

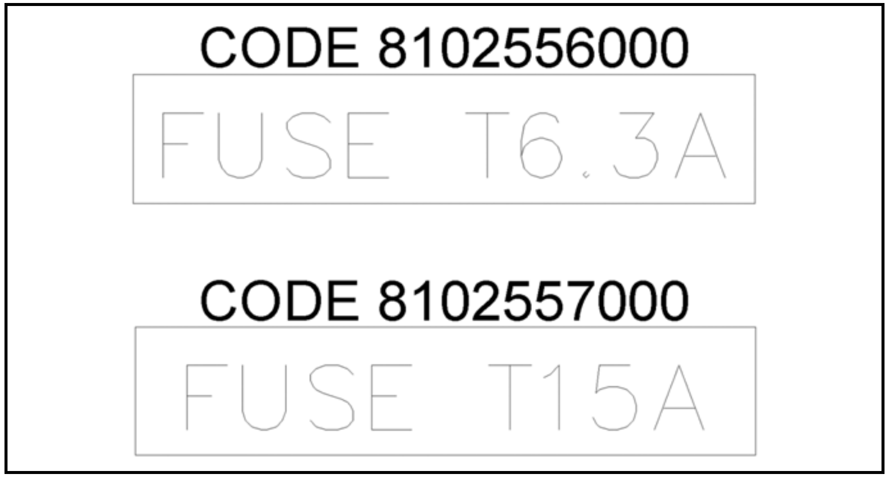


- The secondary fuse already inserted into the secondary stage of the transformer is:

  – Fuse 6.3 A for 220 out put voltage, Ch T

- Attach to the transparent plastic cover of the Main Power Connection the correct label related to the inserted fuse in according with the Country Power Supply.

Fig. 169: Fuse Labels



There are other kinds of fuses used in the System. Some of them are accessible removing the small cover on the main power plug.

These fuses can be found in the spare part installation kit and their values are:

Tab. 4: Fuses vales and positions

Module	Fuse value			Ch
SGRA	6.3 A	10 A	1.6 A	T
SRFA	3.15 a	0.25 a		T
TPM	6.3 a	3.15 a		T

Acceptable Power supply: 100/110/220/230/240 VAC ± 10%, 50/60 ± 10% Hz, 1.3 kW (refer to the Site Planning Guide).

The mains must be equipped with a RCCB (Residual Current Circuit Breaker) even not dedicated. The RCCB is also called ELCB (Earth Leakage Circuit Breaker) or RCD (Residual Circuit Device) or GFI (Ground Fault Interrupter). This device is for breaking a circuit automatically when it senses fraction of an Ampere leakage current flowing to earth in excess to predetermined amount.

The system must be connected directly or through an UPS system to a 16A CB (Circuit Breaker) that is connected to the previously described RCCB. The CB is a re-settable switch that is tripped either by long term over current operated by a thermal mechanism or by short term over current by a magnetic mechanism.

These breakers must have been approved according to the international and/or national and/or federal and/or local regulations in force and they must be installed in a wall-mounted sheltered box near the unit. Wiring between the system and the CB must be via the three-wire cable supplied with the system itself. It must be cut to the appropriate length and cable end sleeves must be inserted before inserting them into the terminal connection.

The equipment must be permanent connected to the Mains (according to EN 60601-1); therefore the cable can be removed only by means of a special tool (e.g. a screwdriver).

Grounding is required. An electric wire with a minimum nominal cross-section of 1.5 mm^2 must ground the equipment (according to EN 60601-1).

The two cables provided with the equipment are the following:

- **Code 810 5901 000** it is the UL/CSA one and must be used in USA and Canada:
  - 10 m long
  - The yellow-green wire is the grounding wire: it must be connected to the ground terminal of the main line
  - The two black numbered cables (phase and neutral) must be connected to the phase and neutral terminals of the CB
  - Nominal cross-section of each of its wires is 15 AWG (about 1,65 mm^2)

- **Code 810 5901 001** it is the IMQ one and must be used in Europe:
  - 10 m long
  - The yellow-green wire is the grounding wire: it must be connected to the ground terminal of the main line
  - The brown wire is the phase wire: it must be connected to the phase terminal of the CB
  - The blue wire is the neutral wire: it must be connected to the neutral terminal of the CB
  - Nominal cross-section of each of its wires is 1.5 mm^2

⚠**WARNING** **Be sure to correctly identify the phase and neutral wires when connecting the equipment or when wiring the separating switch!!!**

The MTCM and the TPM modules will start to heat the Magnet automatically after that the System being connected to the main line and will take approximately 12 hours to reach its rated conditions.

⚠**WARNING** **Don't perform any acquisition while the Fast Heaters are in use (first 24hours of the Magnet warming up)!!!**

If the magnet temperature is below 0 degrees at the time of installation the NTC sensor operates as an open circuit and the MTCM module doesn't provide any power to the heaters. In this case connect the fast heater directly to the main line (220V) for ½ hour maximum. An easy way to do it is connecting the Fast Heater Cable (FQUICK connector of the Magnet Cable) to the PC Unit power cable connected to the PC Extension Cable. After ½ hour replace the normal connections.

⚠**WARNING** **Don't leave the fast heaters plug directly connected to the 220V more then 30 minutes!!!**

If additional optional lights are installed in the pavilion, you must install a dedicated separating switch and insert the power cables into a dedicated duct to avoid electric shocks. The dedicated plug for the optional lights is placed on the filter panel and has the following characteristics: 250 V MAX and 5 A MAX. This power cable must be inserted into the Wave Guide then into the Electronic Unit under the TRI then into the Filter Panel from the internal side in order to connect the RF Cage light power cable externally.

NOTICE No dimmer or fluorescent lights may be used

⚠**WARNING** **All the main power cables and the cables from the console to the filter panel and from the filter panel to the magnet must be inserted under the floor or into the delivered duct that must be fixed to the floor!!!**

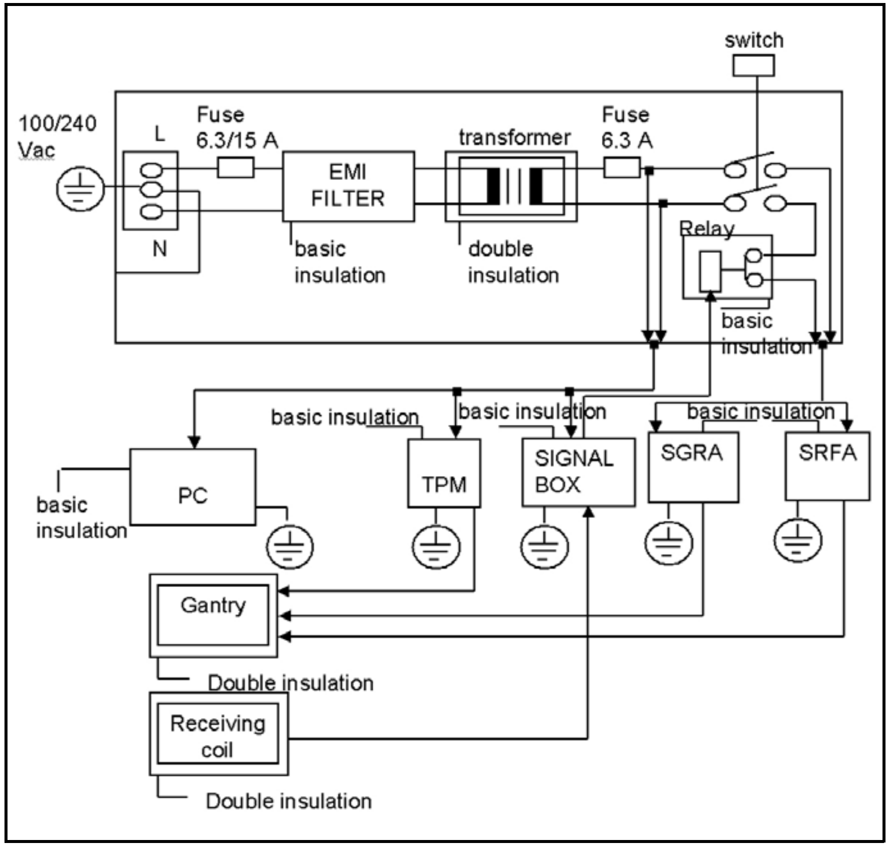
Protective Conductor Test

To perform the following tests an electrical safety tester must be used with the following characteristics:

- **Insulation Resistance**
  Range: 0.5 - 400.0 M Ohms
  Accuracy: ±5% of reading ±2 LSD
- **Protective Earth Continuity**
  Range: 0 - 200 M Ohms at 25 Amps ± 10%
  0-2.999 Ohms at 2-25 Amps AC RMS
  0-2.999 Ohms at 1 Amp AC RMS ± 15%
  Over-range at 2.999 Ohms
  Accuracy: ±5% of reading ± 2 LSD
- **Current Consumption**
  Range: 0 - 15 amps
  Accuracy: ±5% of reading ± 2 LSD
- **Leakage Current**
  Range: 0-49.9 µa, 50-499.9 µa, 500-4999 µa, 5000-8000 µa
  Accuracy: (per IEC 601.1 filter)
  DC - 1 kHz ± 1% of reading ± 1 µa
  1 - 100 kHz ± 2.5% of reading ± 1 µa
  100 kHz - 1 MHz ± 5% of reading ± 1 µa
- **Mains on Applied Part**
  Applied Voltage: 110% of mains voltage
  Range: same as leakage
  Accuracy: ±2% of reading ±6 µa

NOTICE The entire grounding cabling must be installed, before this test can be performed.

Fig. 170: System Insulating Scheme



Leakage Current

They are the measurements in normal condition (NC) and single fault conditions (SFC) of the earth leakage current, and of the patient leakage current in normal condition (NC) according to the EN 60601-1:1990, Clause 19.

The patient leakage current measurement coincides with the enclosure leakage current measurement.

The measured value of the earth leakage current NC shall not exceed 5 mA.

The measured value of the earth leakage current SFC shall not exceed 10 mA.

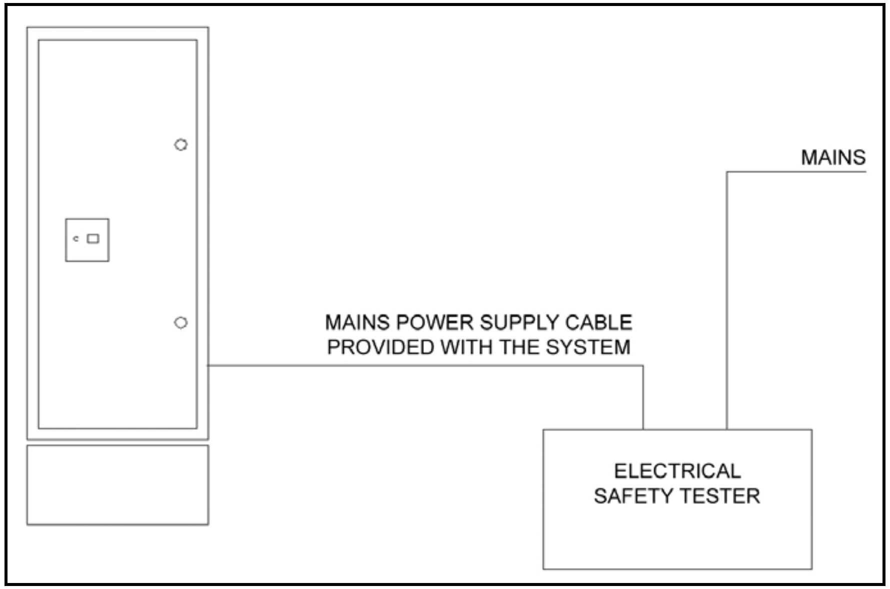
The measured value of the patient leakage current NC shall not exceed 0.1 mA.

Earth leakage current

Measurement conditions:

- The device must be powered
- All the connecting cable, supplied with the device, must have their maximum length
- The test is performed twice, inverting the power supplied to the phase and neutral wires of the power supply cable
- The reported value on the Installation and Quality Form is the worst one between the two measured values
- The test configuration is described in the following figure

Fig. 171: Earth leakage current test configuration

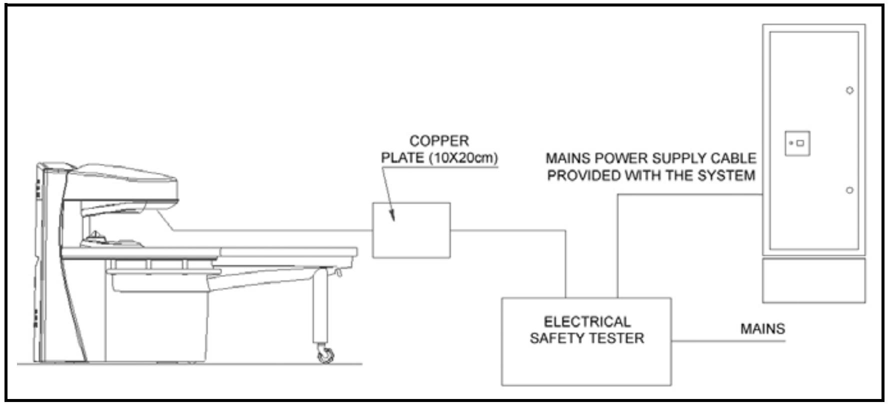


Patient leakage current

Measurement conditions:

- A copper plate 20 x 10 cm is fixed to the inner side of the gantry
- The device must be powered and an RF pulse train sequence must be performed, acting on the SYSTEM CHECK function
- The test is performed twice, inverting the power supplied to the phase and neutral wires of the power supply cable
- The reported value on the Installation and Quality Form is the worst one between the two measured values
- The test configuration is described in the following figure

Fig. 172: Patient leakage current test configuration



Protective Earth Resistance

It is the measurement of the protective earth resistance according to the EN 60601-1:1990, Clause 18. The measured value shall not exceed 0.2 ohm.

Measurement conditions:

- The device must not be powered
- All the connecting cable, supplied with the device, must have their maximum length
- The three-wire power supply cable is connected to the device and its protective earth conductor is connected to the instrument
- The test current is 25 A
- The test configurations are described in the following figures

Fig. 173: Earth Resistance Test Configuration

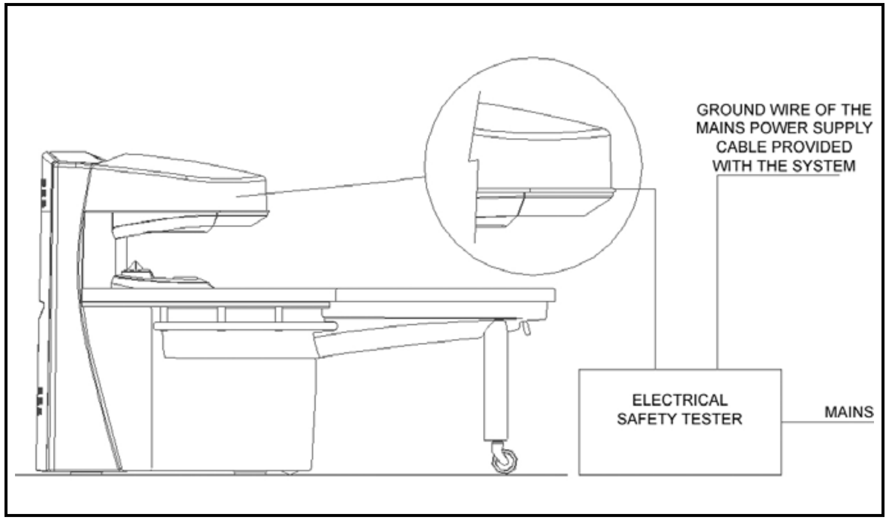
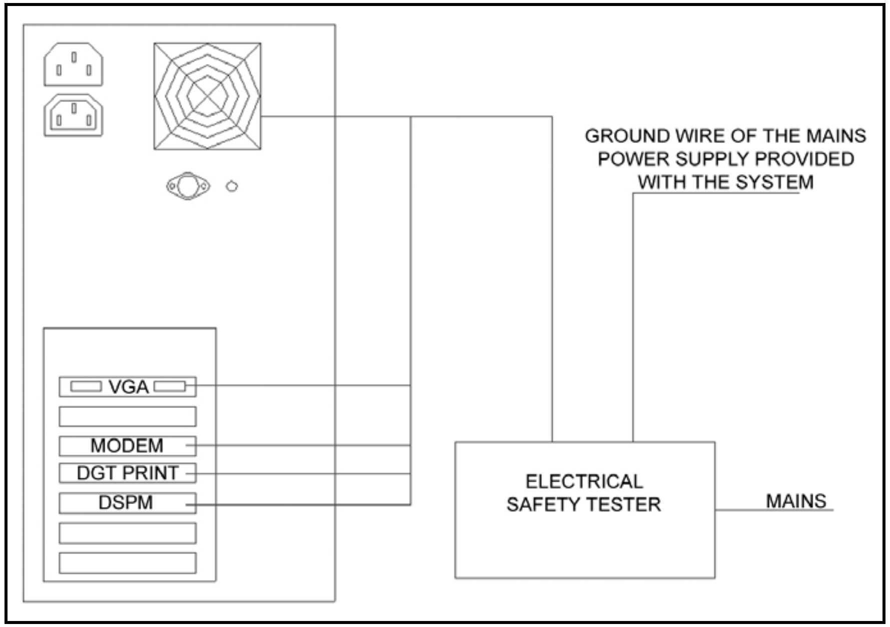

GROUND WIRE OF THE MAINS POWER SUPPLY CABLE PROVIDED WITH THE SYSTEM
ELECTRICAL SAFETY TESTER
MAINS

Fig. 174: Earth Resistance Test Configuration


VGA
MODEM
DGT PRINT
DSPM
GROUND WIRE OF THE MAINS POWER SUPPLY PROVIDED WITH THE SYSTEM
ELECTRICAL SAFETY TESTER
MAINS

- Fill in the Installation and Quality Form with the test results

Final Works

Emergency shutdown buttons

Some countries require emergency shutdown buttons for safety reasons. If they are installed, all emergency shutdown buttons must be tested prior to starting up the MR System. Refer to the following overview.

NOTICE	The System and UPS emergency circuits must be kept separate. The UPS emergency circuit is only needed when the UPS is installed.

Emergency shutdown button test

- Switch on the on-site power supply
- Press and lock the emergency shutdown button
- Check whether
  - The on-site power supply is switched off
  - The on-site power supply remains switched off
- Perform this test for each of the following emergency shutdown buttons:
  - Emergency shutdown / Examination room
- Unlock all emergency shutdown buttons
- Switch on circuit breakers

NOTICE	After the emergency shutdown test the Systems will take some hours to reach the correct temperature

Final Checks

NOTICE	This completes the start-up of your new MR System. Please consider that your customer has purchased an excellent, high-quality MR System with a modern design. The visual impression of the System is equally important to your customer's satisfaction.

- Close all magnet covers
- Close all console covers
- Touch up any paint chips with matching color paint
- Clean any fingerprints off the monitor screens
- Clean any fingerprints off the console covers
- Clean any fingerprints off the System with mild cleaner
- Clean the patient table and the surface coils with mild cleaner
- Clean the area of the System, dispose of empty cartons or other packing materials
- Make sure that the cleaning crew cleans the MR System rooms

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Part 5 Software Update

Introduction

This chapter describes how to update the System software to the last available release. This operation is normally not necessary during System installation: the software is already loaded and contains the System data.

In case of HD failure, refer to the Service Manual, Software Chapter for the complete SW installation including the Operating System.

⚠**WARNING**	**In case of complete SW installation, all the data contained into the HD will be lost!**

Software Up-date

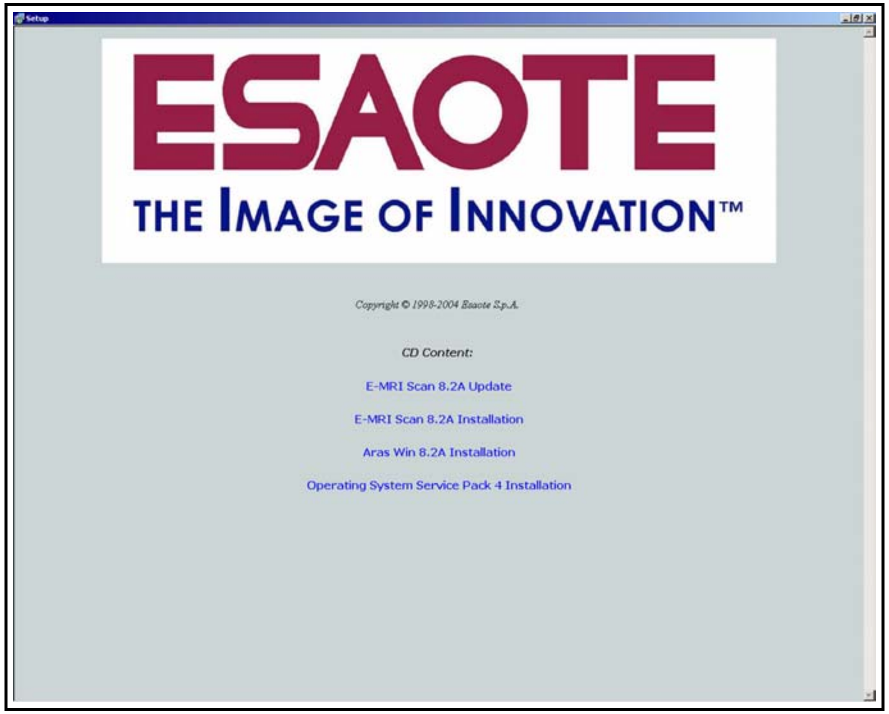
NOTICE	Before to proceed with the SW up-date perform a system back-up and write down all the System importat data such as central frequency, gradient offsets, hardware configurations, etc. etc.

Operating System SP4 Installation

⚠**WARNING**	**If not already installed, this procedure must be carried out before to proceed with the Software Up-date procedure!!!**

- Switch on the System and perform the log on like user **SERV** typing the correct password
- Close OPI after its complete initialization
- Insert into the CDROM the CD containing the new software release
- Select **<START> <PROGRAMS> <UPDATE>**, select the CDROM drive and insert the code **1611** then click on the **OK** button to confirm
- A window appears and you'll have different choices

Fig. 175: Selection page


Setup
ESAOTE
THE IMAGE OF INNOVATION™

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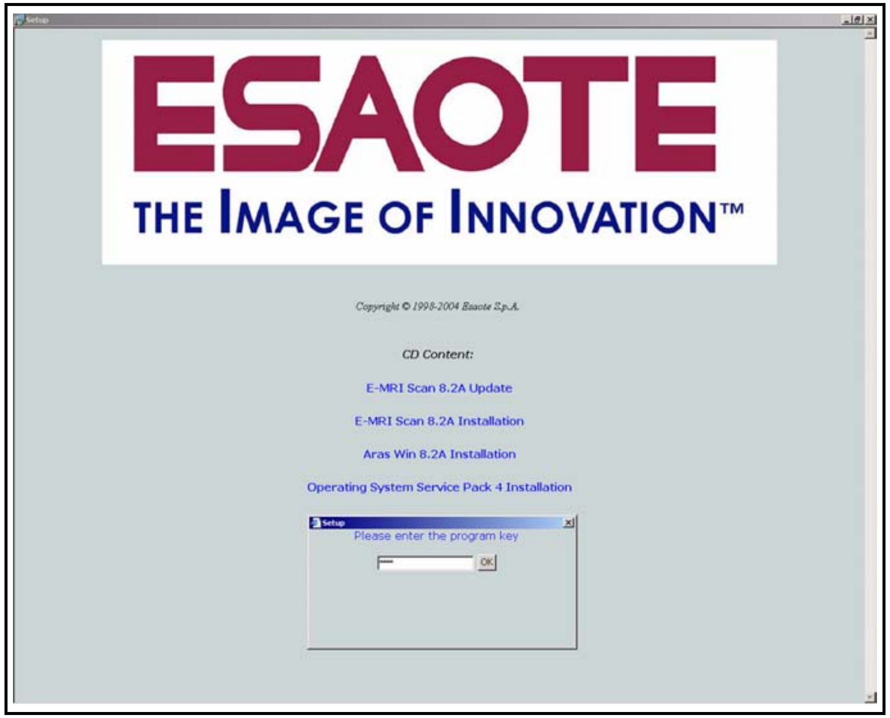
CD Content:
E-MRI Scan 8.2A Update
E-MRI Scan 8.2A Installation
Aras Win 8.2A Installation
Operating System Service Pack 4 Installation

- Select the **Operating System Service Pack4 Installation** and the system will ask you to insert the activation code
- In the next window write **1209** and confirm it pressing the **OK** button

Fig. 176: Selection page: code request


Setup
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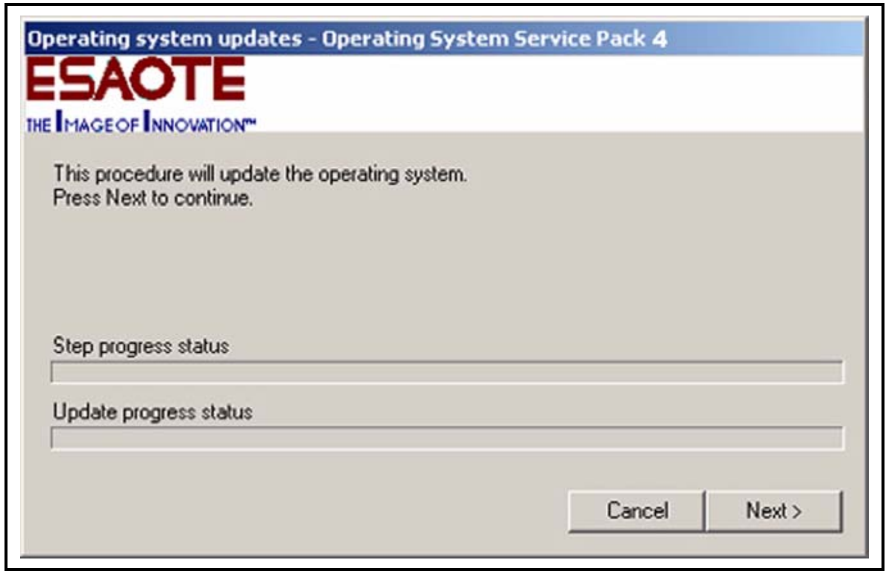
CD Content:
E-MRI Scan 8.2A Update
E-MRI Scan 8.2A Installation
Aras Win 8.2A Installation
Operating System Service Pack 4 Installation
Setup

Please enter the program key

- In the next window press the **NEXT** button to start the OS patch installation

Fig. 177: WIN2000 SP4 installation



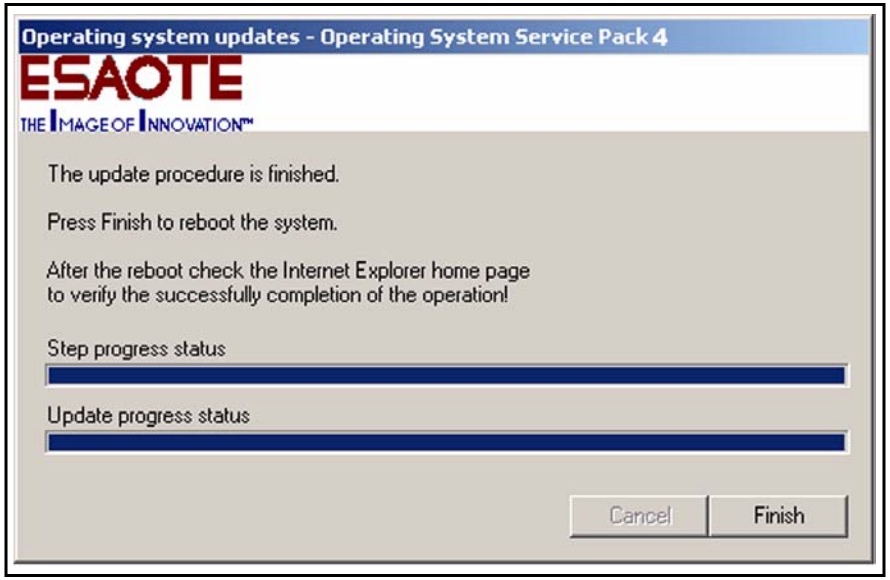
This procedure will update the operating system.
Press Next to continue.

- The procedure goes ahead automatically and will take more or less 20". The system will perform 20 automatic installation steps re-booting between the steps 2 to 3, 17 to 18 and 19 to 20

⚠**WARNING** **Don't interact with the system and wait for the window shown in the next figure!!!**

- When the next window appears click on the **FINISH** button to re-boot the system

Fig. 178: WIN2000 SP4 installed



The update procedure is finished.

Press Finish to reboot the system.

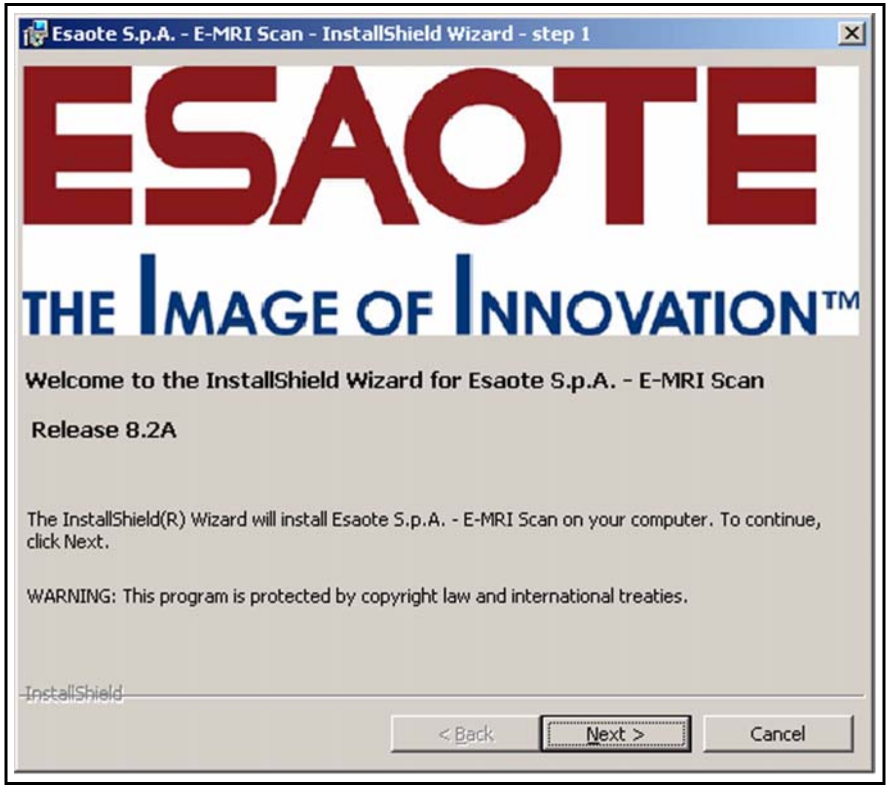
After the reboot check the Internet Explorer home page
to verify the successfully completion of the operation!

- to complete the OP4 installation perform some log on in this order:
  – **SERVDRIVER** (same password as SERV)
  – perform a log off and then log on as **ADMIN**
  – perform a log off and then log on as **ESAMRI**
  – perform a log off and then log on as **SERV**
- Proceed with the OPI SW Release installation

8.2A Update

- Switch on the System and perform the log on like user **SERV** typing the correct password
- Close OPI but only after its complete initialization
- Insert into the CDROM the CD containing the new software release
- Select **<START> <PROGRAMS> <UPDATE>**, select the CDROM drive and insert this code: **1611**
- A window appears and you'll have different choices (as before for the WIN2000 SP4 installation)
- Select the **E-MRI SCAN 8.2A UPDATE** and the system will ask you to insert the correct code
- Write **1611** and confirm it pressing the **OK** button to start the OPI installation
- When the next window appears click on the **NEXT** button

Fig. 179: 8.2A installation



Esaote S.p.A. - E-MRI Scan - InstallShield Wizard - step 1

Welcome to the InstallShield Wizard for Esaote S.p.A. - E-MRI Scan

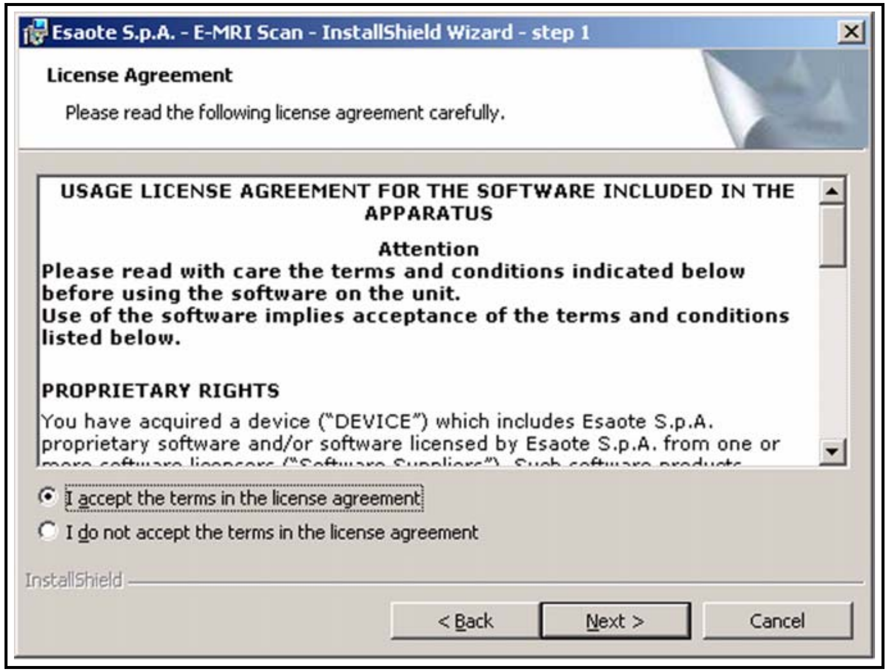
Release 8.2A

The InstallShield(R) Wizard will install Esaote S.p.A. - E-MRI Scan on your computer. To continue, click Next.

WARNING: This program is protected by copyright law and international treaties.

- When the next window appears click on the sentence “**I accept the terms in…”** then click on the **NEXT** button

Fig. 180: 8.2A installation



Esaote S.p.A. - E-MRI Scan - InstallShield Wizard - step 1

License Agreement

Please read the following license agreement carefully.

USAGE LICENSE AGREEMENT FOR THE SOFTWARE INCLUDED IN THE APPARATUS

Attention

Please read with care the terms and conditions indicated below before using the software on the unit.
Use of the software implies acceptance of the terms and conditions listed below.

PROPRIETARY RIGHTS

You have acquired a device ("DEVICE") which includes Esaote S.p.A. proprietary software and/or software licensed by Esaote S.p.A. from one or

● I accept the terms in the license agreement

○ I do not accept the terms in the license agreement

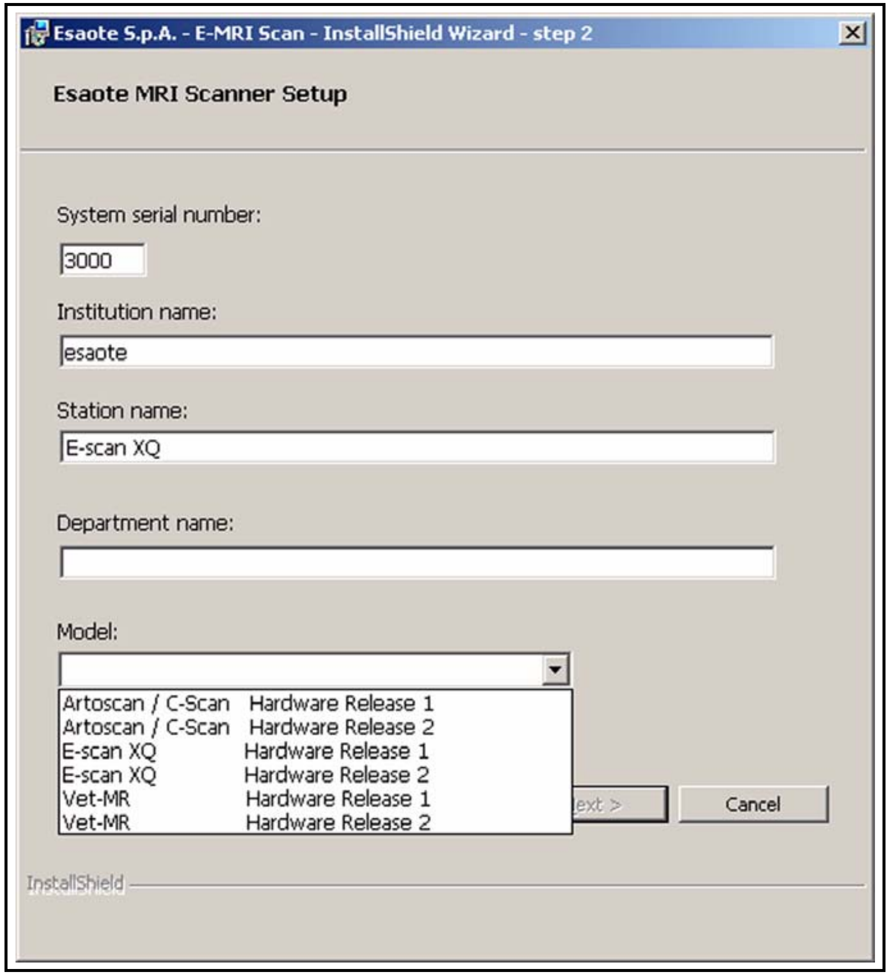
- The procedure goes ahead automatically and will take more or less 5". The system will perform the software installation steps

---

⚠**WARNING** **Don't interact with the system and wait for the window shown in the next figure!!!**

- When the next window appears check if the present data are correct then click on the **NEXT** button. The data should be automatically loaded by the software update procedure and then just displayed with no possibility to modify them

Fig. 181: 8.2A installation



Esaote S.p.A. - E-MRI Scan - InstallShield Wizard - step 2

Esaote MRI Scanner Setup

System serial number: 3000

Institution name: esaote

Station name: E-scan XQ

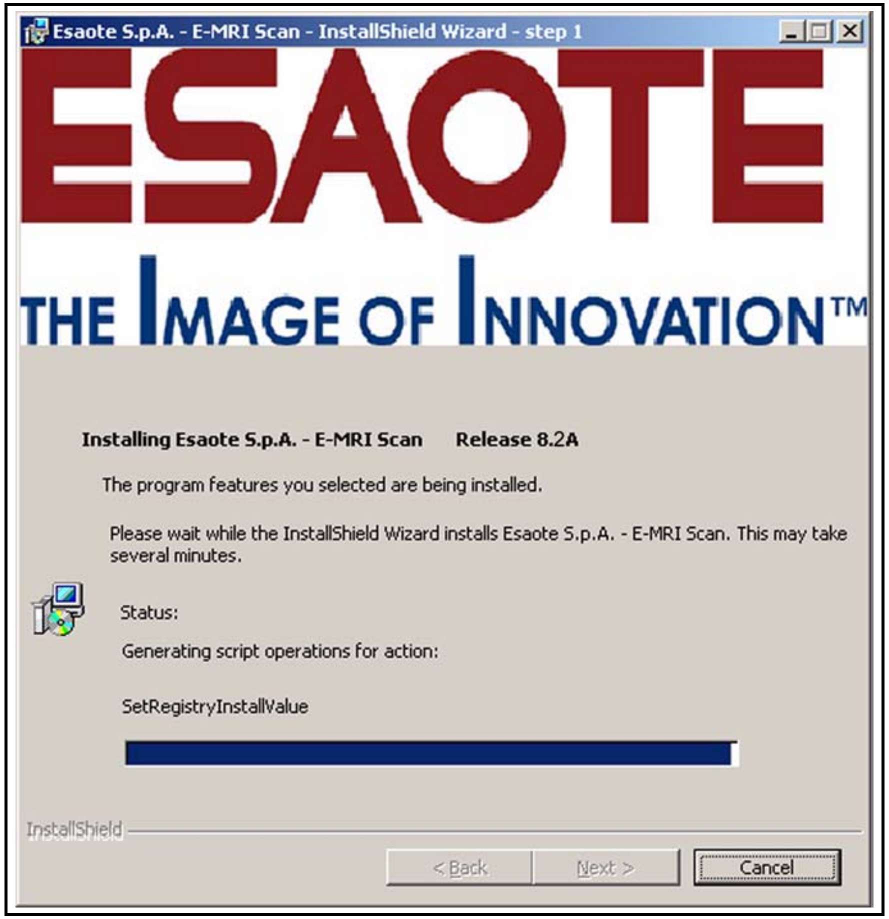
Department name:

Model:

Artoscan / C-Scan	Hardware Release 1
Artoscan / C-Scan	Hardware Release 2
E-scan XQ	Hardware Release 1
E-scan XQ	Hardware Release 2
Vet-MR	Hardware Release 1
Vet-MR	Hardware Release 2

NOTICE E-SCAN XQ Hardware Release 2 means DGT-NE!!!

Fig. 182: 8.2A installation



Installing Esaote S.p.A. - E-MRI Scan Release 8.2A

The program features you selected are being installed.

Please wait while the InstallShield Wizard installs Esaote S.p.A. - E-MRI Scan. This may take several minutes.

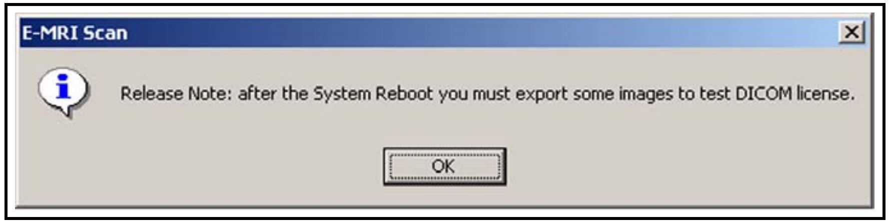
Status:

Generating script operations for action:

SetRegistryInstallValue

- The procedure goes ahead automatically and will take more or less 3".
  Don't interact with the system till that the log on mask is shown!!!
- If the following message appear click on the **OK** button

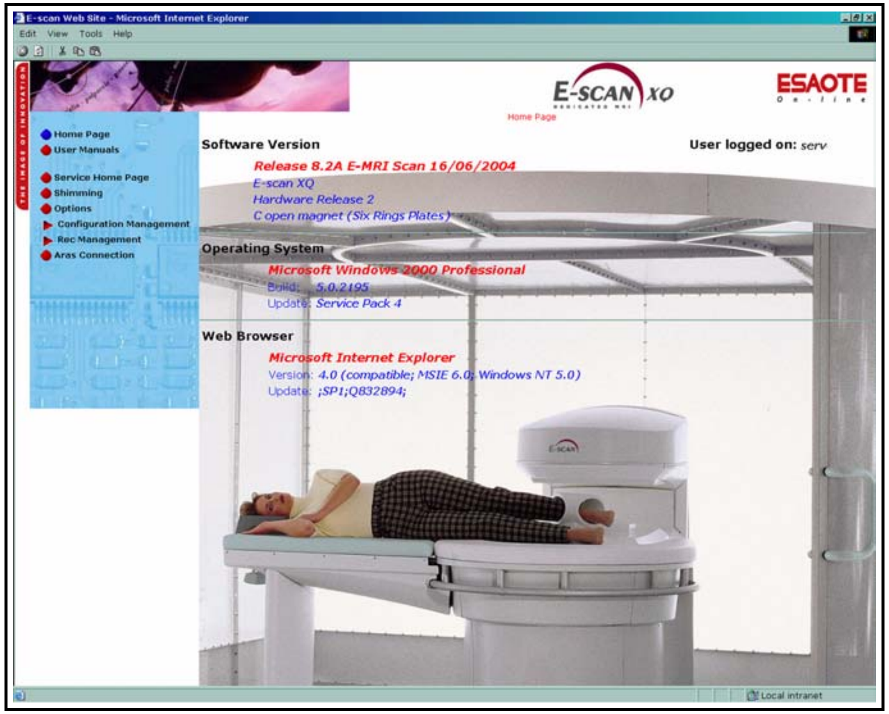
Fig. 183: 8.1A installation step4



Release Note: after the System Reboot you must export some images to test DICOM license.

- Perform a log-on as **SERV** and check in the IE homepage if the Operating System SP4 has been correctly installed (compare the shown data against the date shown in the following figure)

Fig. 184: IE homepage



Software Version

User logged on: *serv*

Release 8.2A E-MRI Scan 16/06/2004
E-scan XQ
Hardware Release 2
C open magnet (Six Rings Plates)

Operating System

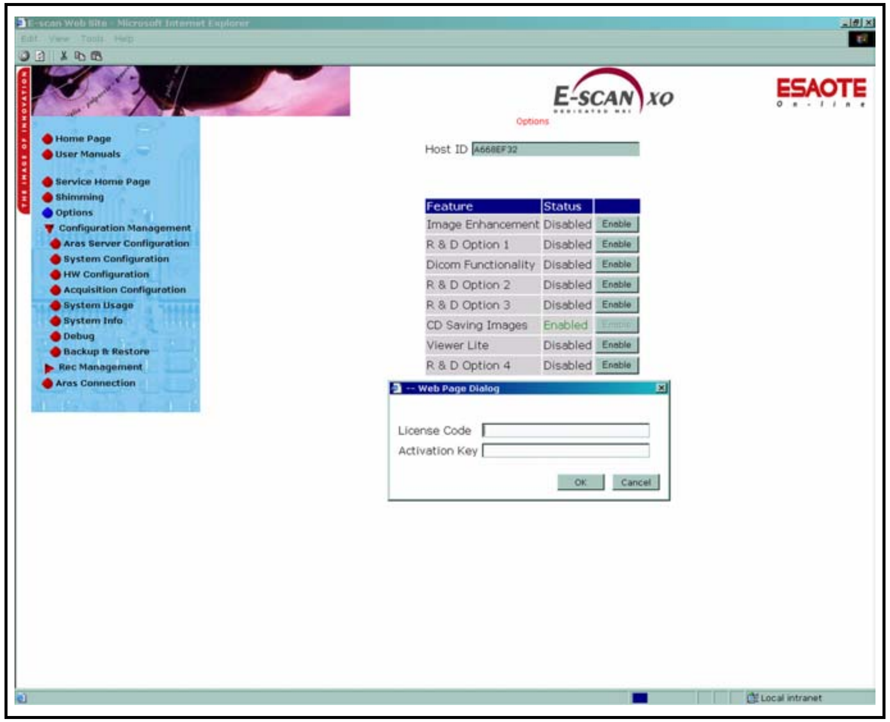
Microsoft Windows 2000 Professional
Build: *5.0.2195*
Update: *Service Pack 4*

Web Browser

Microsoft Internet Explorer
Version: *4.0 (compatible; MSIE 6.0; Windows NT 5.0)*
Update: *;SP1;Q832894;*

- check if the System Options are set and enabled (some of them are for R&D only)

Fig. 185: IE Options page



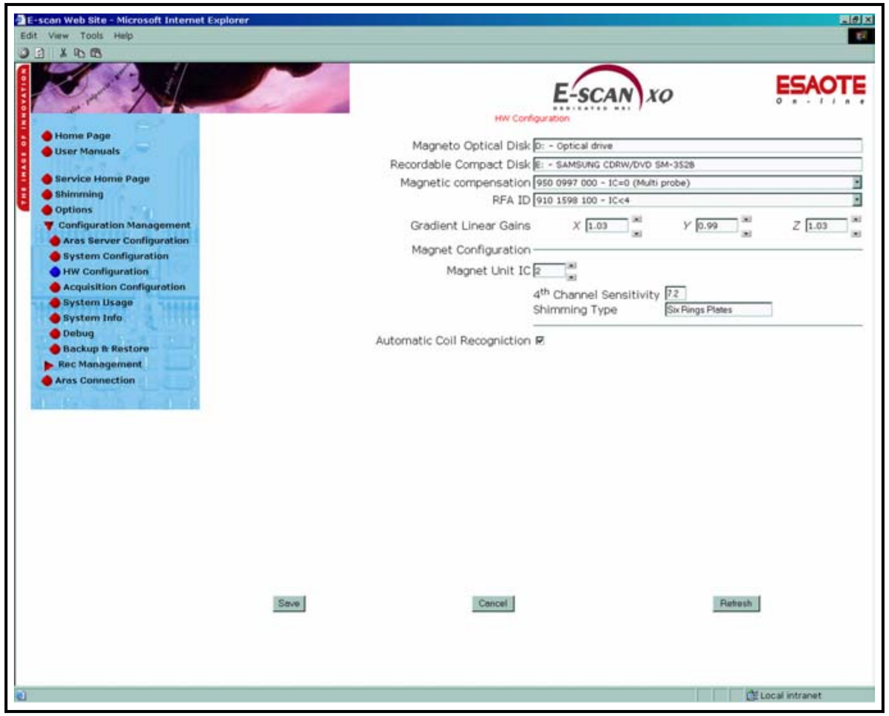
Host ID A668EF32

Feature	Status	
Image Enhancement	Disabled	Enable
R & D Option 1	Disabled	Enable
Dicom Functionality	Disabled	Enable
R & D Option 2	Disabled	Enable
R & D Option 3	Disabled	Enable
CD Saving Images	Enabled	Enable
Viewer Lite	Disabled	Enable
R & D Option 4	Disabled	Enable

License Code
Activation Key

- Set the Hardware Configuration page in according with your system component status

Fig. 186: IE hardware configuration page



Magneto Optical Disk: D: - Optical drive

Recordable Compact Disk: E: - SAMSUNG CDRW/DVD SM-352B

Magnetic compensation: 950 0997 000 - IC=0 (Multi probe)

RFA ID: 910 1598 100 - IC<4

Gradient Linear Gains: X 1.03 Y 0.99 Z 1.03

Magnet Configuration

Magnet Unit IC: 2

4th Channel Sensitivity: 7.2

Shimming Type: Six Rings Plates

Automatic Coil Recogniction ☑

- Perform a log off and then log on like **ADMIN**
- If the system has the DICOM Option performs the following steps otherwise skip them and go the next point:
  - Open IE and select the **DICOM Configuration** page
  - Select **MODIFY** and select the printer then save the configuration
  - Perform a log off and then log on like **ESAMRI** and test the DICOM printing functionality
- Perform a log off and then log on as **ESAMRI** if you didn’t do it before
- Perform a log off and then log on as **SERVDRIVER** and check if all the PC UNIT components are correctly installed
- The procedure is over

Part 6 Tune-Up

General

Welcome to the MR System tune-up

The tune-up procedure includes a number of adjustments and checks for obtaining optimal performance and image quality with your MR System.

Proceed with care even though most of the procedures run more or less automatically.

NOTICE	Unless specified differently, all the phantoms are inserted into the gantry in axial position

Overview

The calibration parameters of the System must be checked both at the time of installation and whenever scheduled maintenance is performed. At these times, quality tests will also have to be carried out to guarantee the required standard of performance, especially concerning the quality of the resulting images. For this reason, a control program for the machines is provided. This program includes the periodical checking of the various variables. Final inspection is the first testing of the program and it will be followed by other checks performed during service. An installation protocol must also be prepared and must be completed in all of its parts. A copy of this protocol must be returned to the central service offices.

All calibration results relating to the various parameters of the System and those concerning the quality tests are to be recorded in this protocol to be compared with the corresponding reference values.

The entire calibration procedure may be managed from the Operator Interface (OPI). Specifically, some calibration procedures are automatic, whilst others require the active participation of the operator. These latter procedures must be referred to as manual calibrations. The System's calibration parameters are stored in one file: “.predef.proto”. This file is copied to the “.predef” file, which is the actual file being used during acquisitions. The automatic calibration procedures, after ascertaining the correct value of the parameter to be calibrated, save the value to a temporary file only, without changing its default value. Moreover, the calibration procedure stores all the information necessary for following up the operation in appropriate record files. Manual calibration may intervene also on the file relating to the coils, e.g. on the default values that have been set at the factory during the final inspection of the apparatus, thus allowing a knowledgeable control of the operation of critical equipment during malfunctioning. Since these operations require the user to know how to operate the machine, please refer to the relevant sections of the User Manual. The phantoms supplied with the machine and the manual calibration System will be described below.

Necessary tools

- Wrenches set
- Screwdriver, small and large standard tips and medium Philips tip
- Non ferromagnetic tools

Scout Acquisition

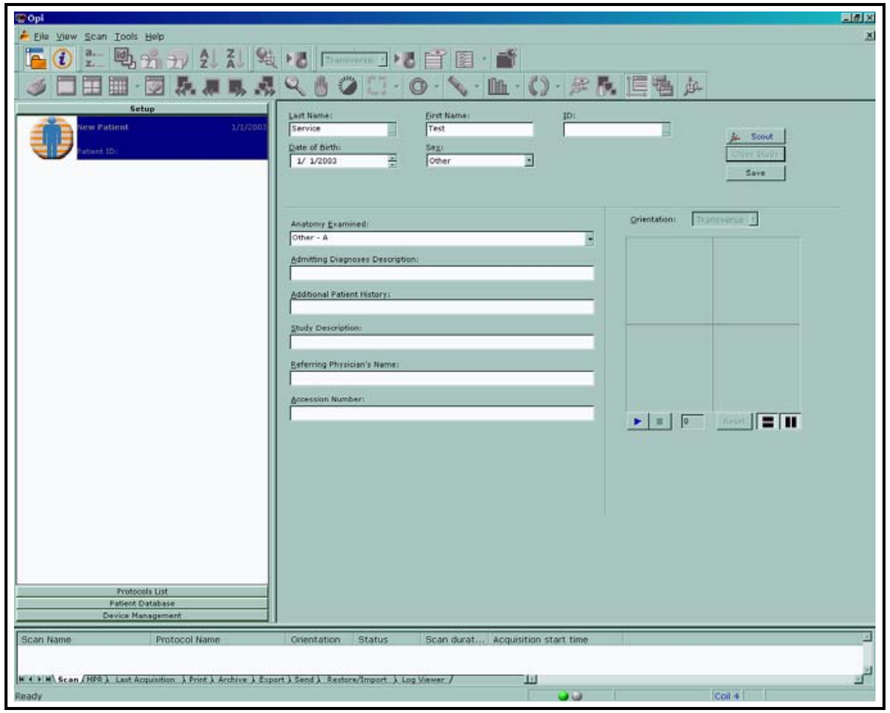
During the system calibration several Scout acquisitions have to be performed. The Scout is a dedicated sequence necessary to set the system parameters taking care of the magnet frequency and patient's load and to identify the patient position during the real examination. The Scout sequence must be acquired from the Customer Operator Interface (OPI), it's not possible to acquire a Scout from the Service Operator Interface (ARAS). OPI is automatic initialized by the system when the Operating system has been loaded.

Scout Setup

NOTICE	Never check the **<Acquisition>** tab on the Scout setup window performing a Scout for Service porpoises (this tab is used only by Users)

- Before to perform a Scout is necessary to create a new patient. To have access to the patient's identification data from the OPI there are two possible ways:
  - Click on **<File> <New> <Patient>** to display the Scout examination data window and create a new patient
  - Click on the first icon of the OPI toolbar
- The operator shall enter the patient's identification data and some information about the examination procedure, such as the anatomic zone to be examined

Fig. 187: Scout Settings



Last Name: Service

First Name: Test

ID:

Date of Birth: 1/ 1/2003

Sex: Other

Anatomy Examined: Other - A

Admitting Diagnoses Description:

Additional Patient History:

Study Description:

Referring Physician's Name:

Accession Number:

- Only some fields are filled with default values, while the others must be filled explicitly for a new examination session to start. Some fields are compulsory. These are, respectively, **<Last Name>, <First Name>, <Birth>** and **<Anatomy Examined>** (under the **<Study>** flag). It is not possible to close the session and save the current patient's data, or start a Scout until all the compulsory data has been entered. The field **<ID>** is not compulsory: it contains the Patient's identification number. The field **<Sex>** allows two alternative options: **<Male>** or **<Female>** or **<Other>**. Date-of-birth format is **“dd-mm-yyyy”**: **dd** for day, **mm** for month and **yyyy** for year. In this case the acknowledged characters are digits and hyphens

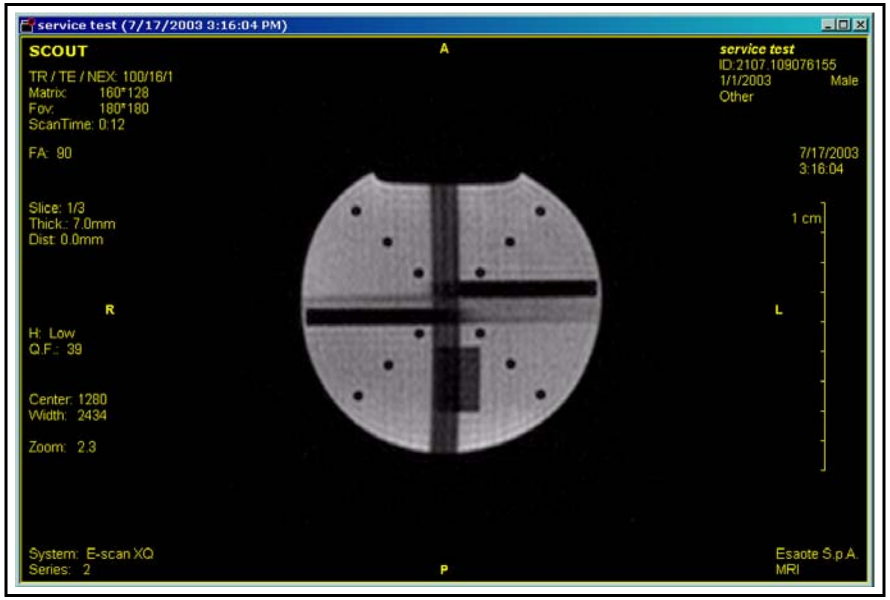
- When all the fields are filled in it's possible to click on the **<Study>** flag to select the anatomy.

NOTICE **<Other>** and Bed position **<A>** must be select acquiring Scout for Service purposes

---

- If the Automatic Coil recognition is enable is not necessary select the inserted coil otherwise click on the **<Coil>** flag and select the correct one
- Click on the **<Save>** button to save the inserted data and click on **<Scout>** if you want to perform the scout acquisition otherwise close the window and now a new Patient is created
- To perform click on the **Scout** icon of the OPI toolbar or select **<Scan>** then **<Scout>** from the OPI toolbar
- To follow which calibration the system is performing during the Scout acquisition, click on the **<Logger>** flag (window bottom toolbar)
- To visualize the Scout after it's acquisition click on the **<Scan>** flag (window bottom toolbar)

Fig. 188: Scout done



service test (7/17/2003 3:16:04 PM)

SCOUT
TR / TE / NEX: 100/16/1
Matrix: 160*128
Fov: 180*180
ScanTime: 0:12
FA: 90
Slice: 1/3
Thick.: 7.0mm
Dist: 0.0mm
H: Low
Q.F.: 39
Center: 1280
Width: 2434
Zoom: 2.3
System: E-scan XQ
Series: 2

service test
ID:2107.109076155
1/1/2003 Male
Other
7/17/2003
3:16:04

Esaote S.p.A.
MRI

- All the sequence acquisition (also for Service porpoise) has to be acquired from the OPI interface. In the window bottom part, the queued sequences are shown

Quick Tuning

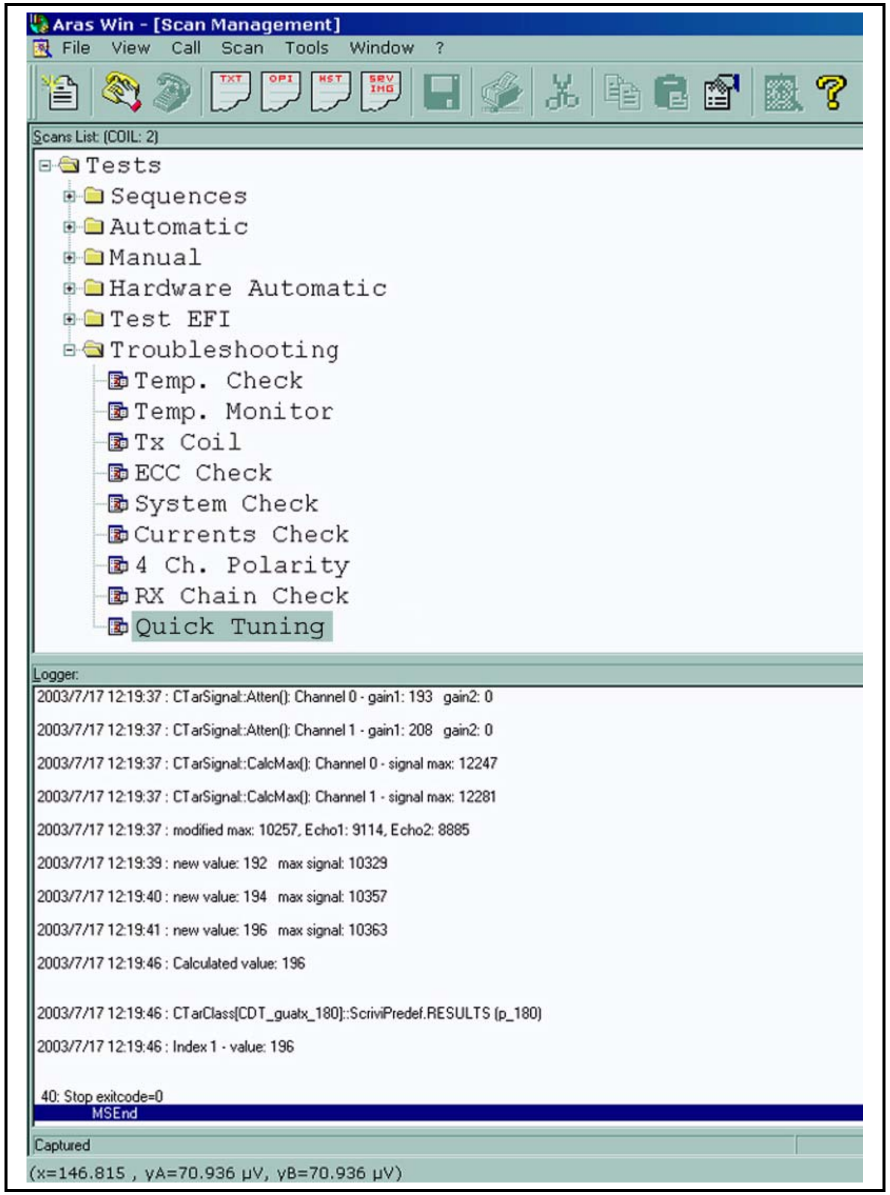
A new function is present in the ARAS Menus: the Quick Tuning function.

Every time we perform the SCOUT acquisition the system performs many automatic checks (e.g.: temp, shielding, etc.) and calibrations (e.g.: frequency, varicap, 180° pulse, etc.) and then acquires three images.

The Quick Tuning performs exactly the same checks and calibrations as the Scout but without the images acquisition saving time specially if you are working in ARAS and to perform the Scout you have to swap to OPI and then come back to ARAS.

Use this button every time you change the phantom inside the coil or you change the coil.

Fig. 189: Quick Tuning



```
2003/7/17 12:19:37 : CTarSignal::Atten(): Channel 0 - gain1: 193   gain2: 0
2003/7/17 12:19:37 : CTarSignal::Atten(): Channel 1 - gain1: 208   gain2: 0
2003/7/17 12:19:37 : CTarSignal::CalcMax(): Channel 0 - signal max: 12247
2003/7/17 12:19:37 : CTarSignal::CalcMax(): Channel 1 - signal max: 12281
2003/7/17 12:19:37 : modified max: 10257, Echo1: 9114, Echo2: 8885
2003/7/17 12:19:39 : new value: 192   max signal: 10329
2003/7/17 12:19:40 : new value: 194   max signal: 10357
2003/7/17 12:19:41 : new value: 196   max signal: 10363
2003/7/17 12:19:46 : Calculated value: 196

2003/7/17 12:19:46 : CTarClass[CDT_guatx_180]::ScriviPredef.RESULTS (p_180)
2003/7/17 12:19:46 : Index 1 - value: 196

 40: Stop exitcode=0
      MSEnd
```

```
(x=146.815 , yA=70.936 µV, yB=70.936 µV)
```

ARAS Settings and Features

All the System calibration must be performed from the Service Operator Interface (ARAS).

To launch it, it's necessary perform the system log on writing in the user field the word SERV and the correct password.

NOTICE	If you don't know the correct password, ask it to the ESAOTE headquarter

The ARAS software integrates the “Diascope” function used to identify broken modules or to perform some tests.

No special equipment are necessary: all the hardware and software tools are already integrated into the system. The main feature of this diagnostic instrument is to display signals sampled by the machine.

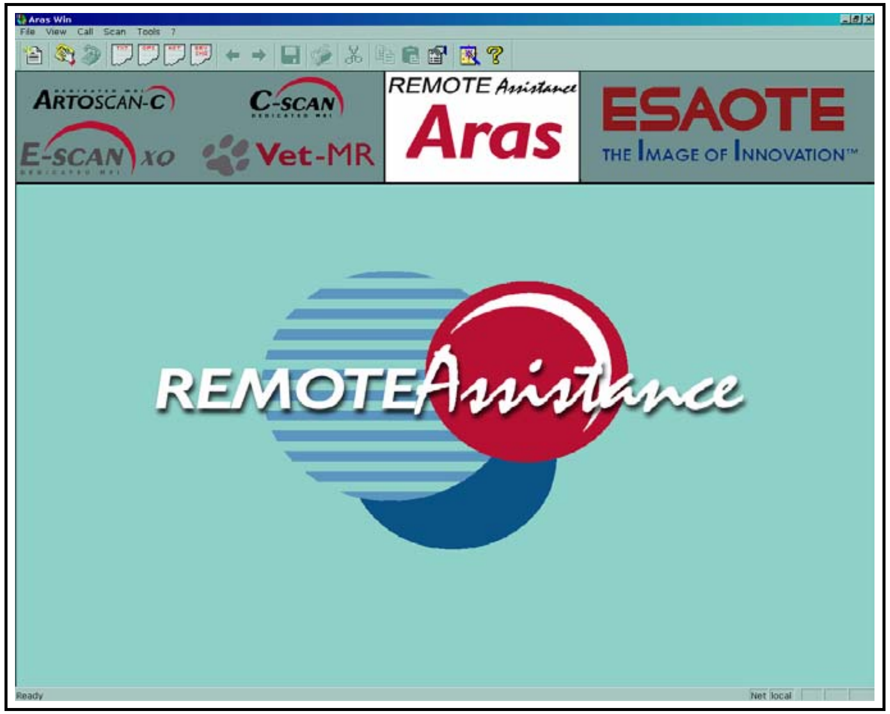
ARAS connection

- To start it switch on the system (or perform a log off is the system is already on) and log it on typing **SERV** in the user name field and the correct password

NOTICE	If you don't know the Service Password call the ESAOTE Service headquarter

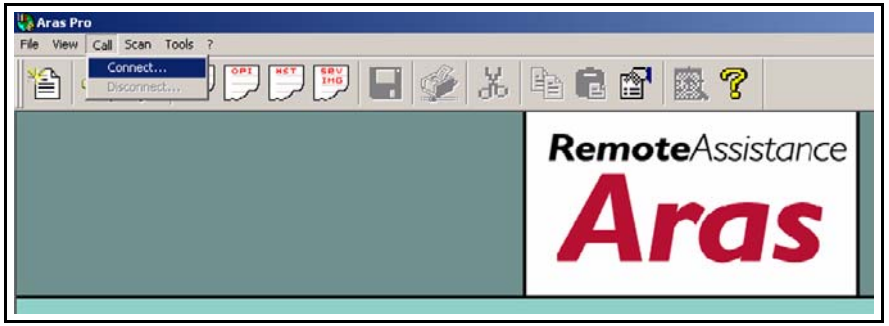
- When the boot is finished and the OPI Program is open, click on the **START** button the select **Programs** and **ARAS**

Fig. 190: ARAS Window



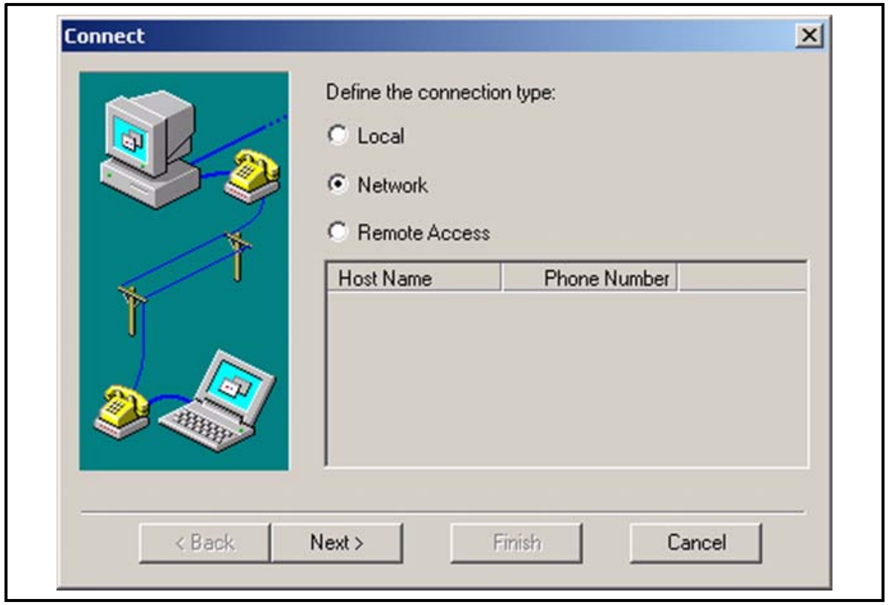
- If not opened automatically by the System, select **<Call>** then **<Connect>** from the **ARAS** toolbar (like shown in the next figure)

Fig. 191: ARAS Toolbar



- From the **Connect** window select the **<Network>** option then click on **<Next>** button

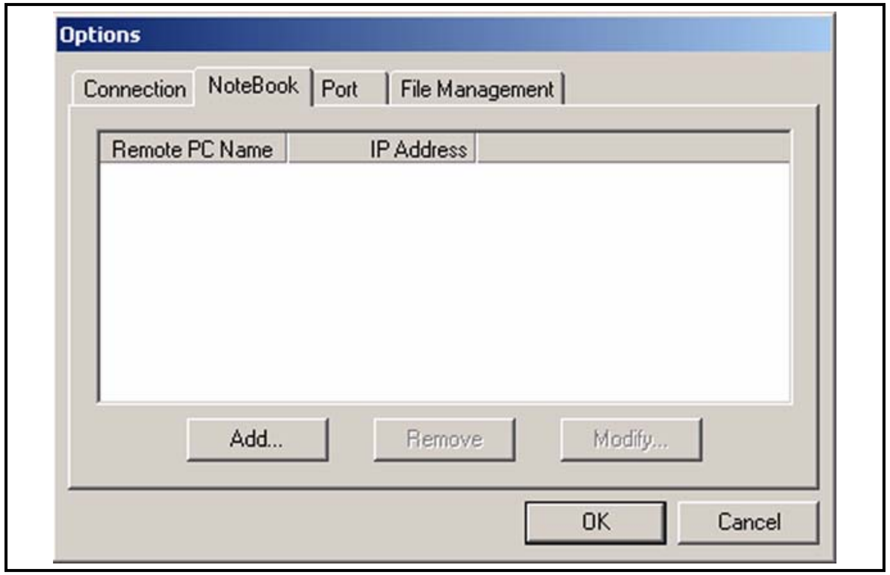
*Fig. 192: Choose the **Network** connection*



○ Local
● Network
○ Remote Access

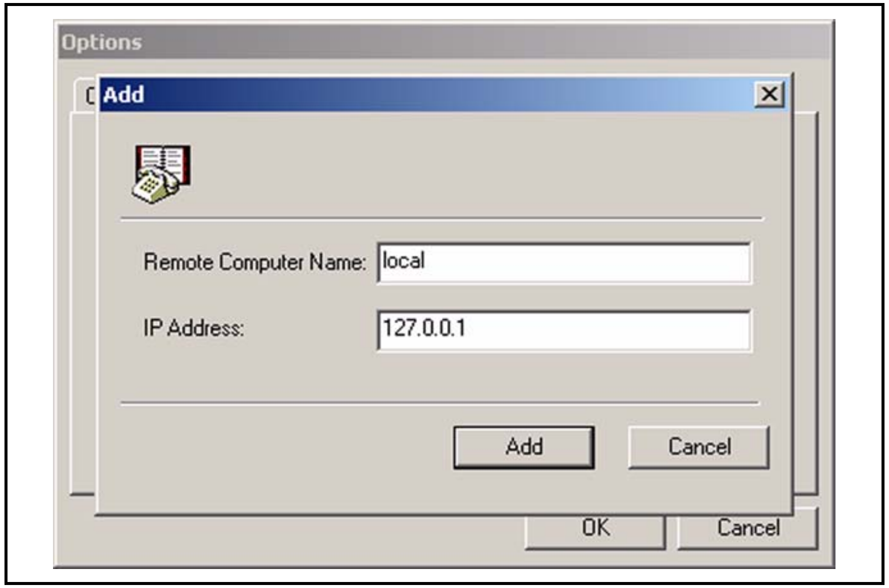
- If the **<Network>** option is empty and only if, follow these steps otherwise skip them and go to the following **dot**
  - Quit from the **Connect** window and select, from the ARAS toolbar, **<View> <Options>** and the **<Notebook>** flag then click on **<ADD>** button

Fig. 193: No Network data



  - Fill in the empty fields like shown in the next figure the click on the **<ADD>** button

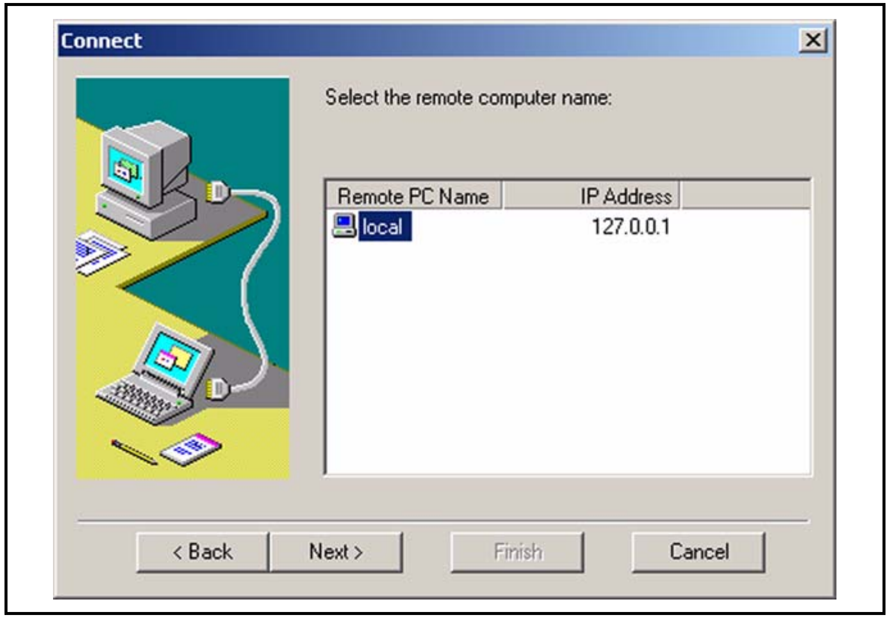
Fig. 194: Local connection data



Remote Computer Name: local

IP Address: 127.0.0.1

Fig. 195: Local connection



Select the remote computer name:

Remote PC Name	IP Address
local	127.0.0.1

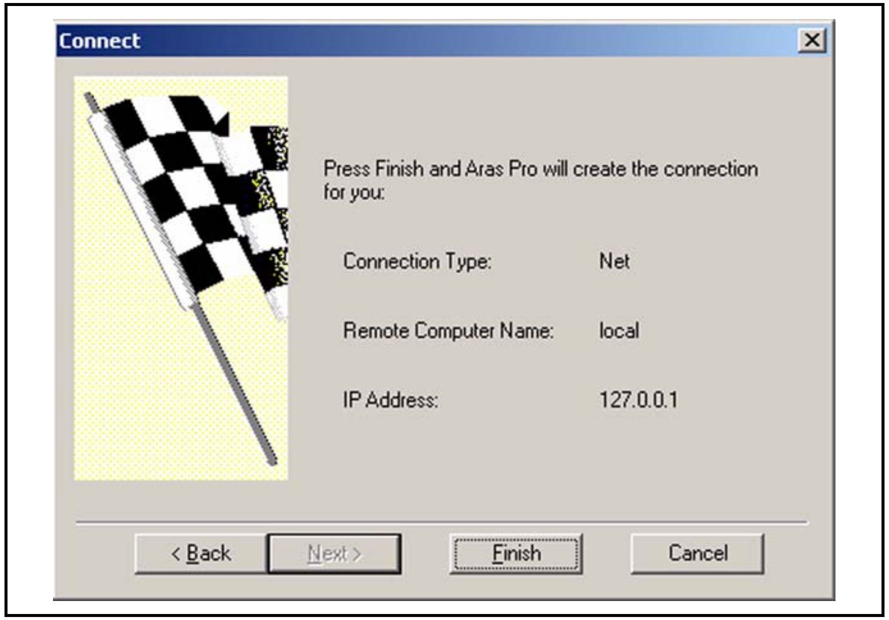
– Click on the **<OK>** button to save the inserted data

– Now select again **<Call>** from the toolbar then **<Connect>**, choose the **<Network>** option and click on the **<Next>** button

- Select the LOCAL address like shown in the next window

- Click on the **<Next>** button and on **<Finish>** to establish the connection

Fig. 196: Local Finish



Press Finish and Aras Pro will create the connection for you:

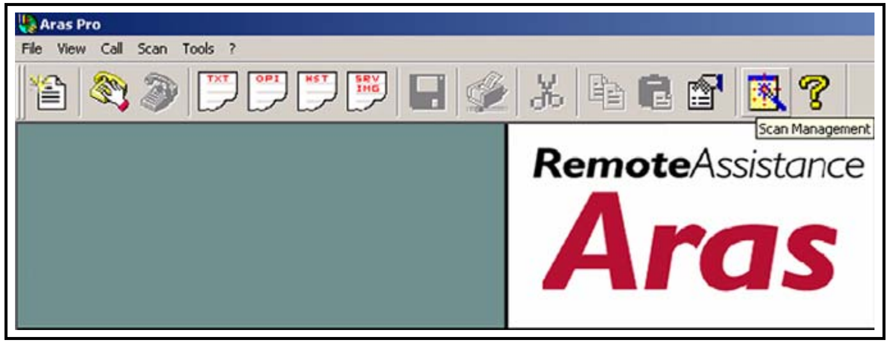
Connection Type: Net

Remote Computer Name: local

IP Address: 127.0.0.1

- Now wait for the SW initialization before click on the **<Scan Management>** icon from the ARAS toolbar

*Fig. 197: **<Scan Management>** icon from the ARAS toolbar*

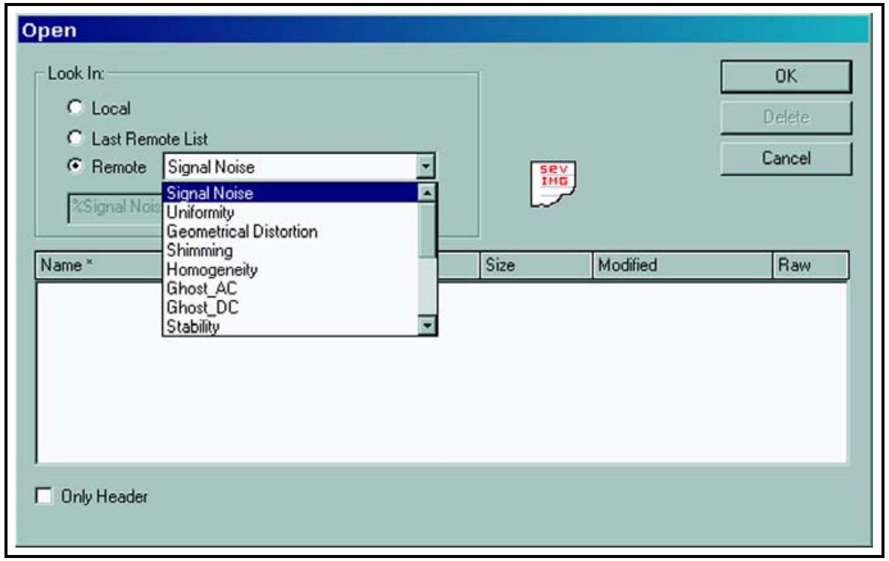


- While the System is performing the initialization, the next window will appear. Only when the TEST folder is enabled the initialization is completed

How to load Service images

- Click on SERV IMG button from the ARAS Toolbar
- Select the REMOTE option and open the drop down menu to select the wanted images

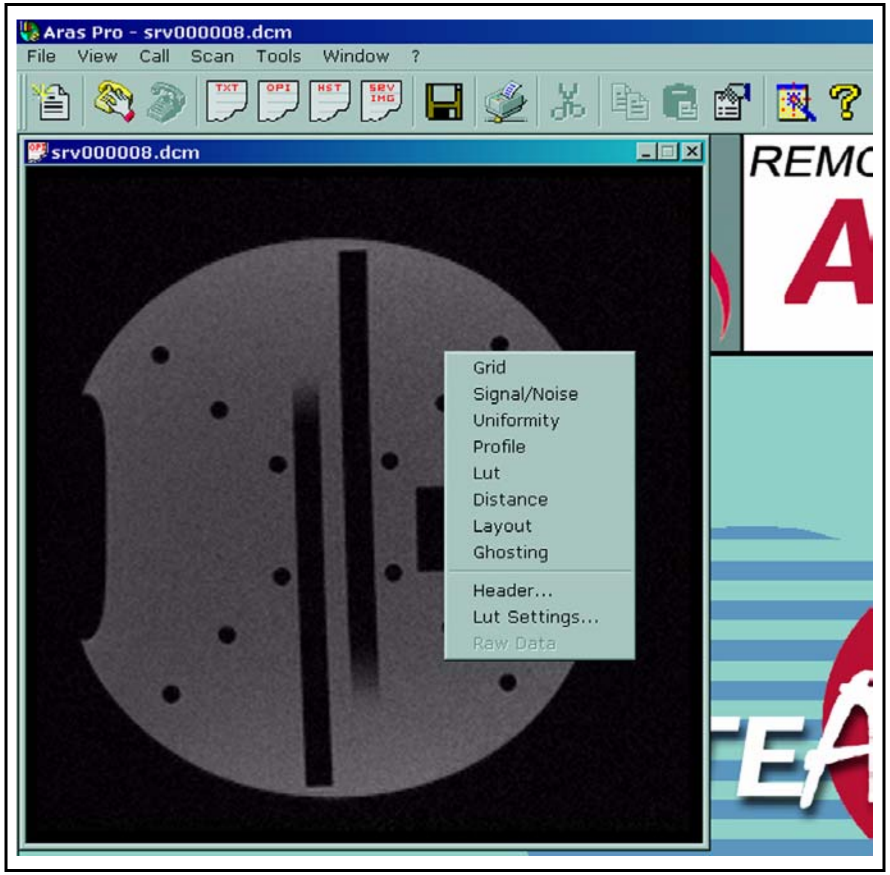
Fig. 198: Image Selections



How to perform measurements

- When the images are displayed by the ARAS program, move the mouse prompt on the image and click on the right button mouse and the measurement menu will appear then select the wanted functionality and the System will perform the measurement and will show the values

Fig. 199: ARAS Measure menu

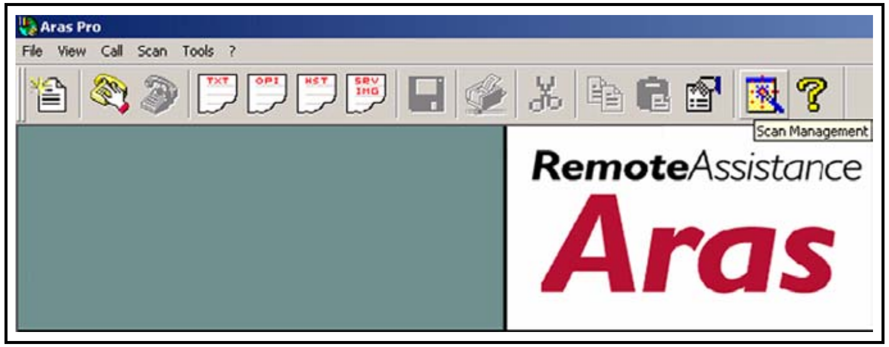


ARAS Features

ARAS Toolbar

- The toolbar will appear at the top of the desktop when this option is active

Fig. 200: Toolbar



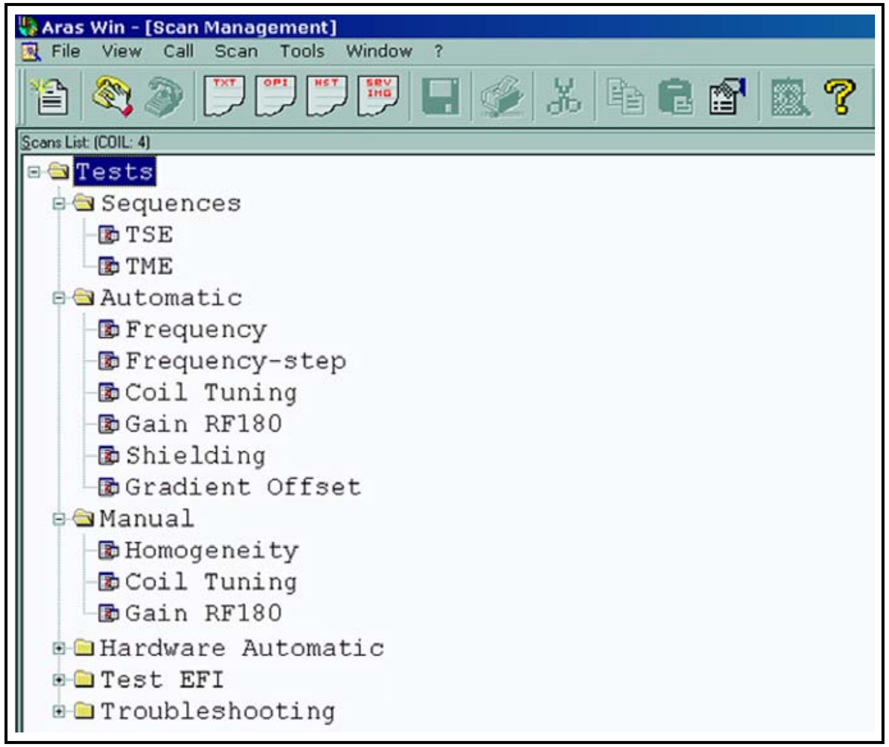
Tab. 5: ARAS Toolbar Buttons

Icon	Function	Icon	Function
📄	Create a new text format file	💾	Save the file on the local system
☎	Connect to the system	🖨	Print on the predefined printer
☎	Disconnect from the system (only for the remote connection)	✂	Cut
TXT	Open a txt file on the local or on the remote	📋	Paste
REC	Open a rec file on the local or on the remote	📄	Open to the option menus
OPI	Open an opi file on the local or on the remote	🔍	Open to scan management window
HST	Open an hst file on the local or on the remote	?	About
📄	Copy		

ARAS Test Folders

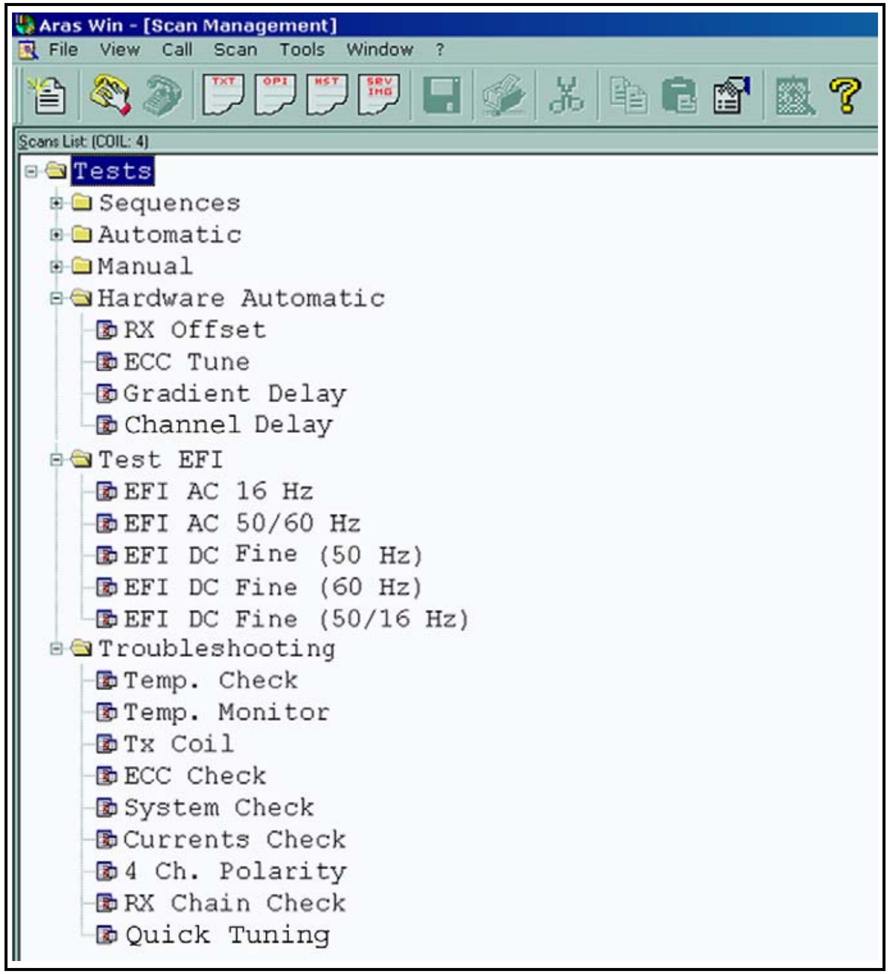
- Inside the TEST folder you find all the system calibrations, like shown in the next figures

Fig. 201: Sequences, Automatic and Manual folders


Aras Win - [Scan Management]
File View Call Scan Tools Window ?
TXT OPI HST SRV IMG
Scans List: (COIL: 4)

- Tests
  - Sequences
    - TSE
    - TME
  - Automatic
    - Frequency
    - Frequency-step
    - Coil Tuning
    - Gain RF180
    - Shielding
    - Gradient Offset
  - Manual
    - Homogeneity
    - Coil Tuning
    - Gain RF180
  - Hardware Automatic
  - Test EFI
  - Troubleshooting

Fig. 202: Hardware Automatic, Test EFI and Trouble Shooting folders


Aras Win - [Scan Management]
File View Call Scan Tools Window ?
TXT OPI HST SRV IMG
Scans List: (COIL: 4)

- Tests
  - Sequences
  - Automatic
  - Manual
  - Hardware Automatic
    - RX Offset
    - ECC Tune
    - Gradient Delay
    - Channel Delay
  - Test EFI
    - EFI AC 16 Hz
    - EFI AC 50/60 Hz
    - EFI DC Fine (50 Hz)
    - EFI DC Fine (60 Hz)
    - EFI DC Fine (50/16 Hz)
  - Troubleshooting
    - Temp. Check
    - Temp. Monitor
    - Tx Coil
    - ECC Check
    - System Check
    - Currents Check
    - 4 Ch. Polarity
    - RX Chain Check
    - Quick Tuning

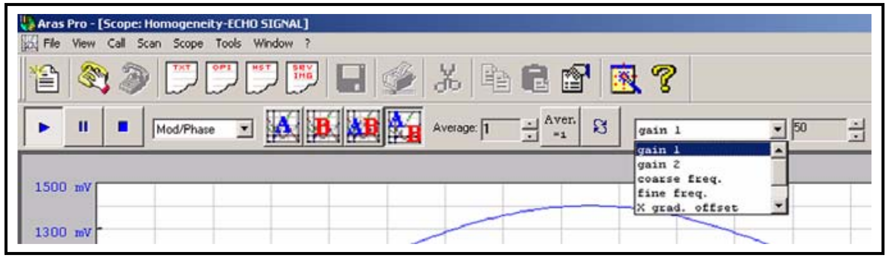
ARAS Diascope Features

“Diascope” functionality

This instrument consists of an interface embodying the key features of an oscilloscope, a being an extremely useful instrument for analyzing analog signals. For this reason, this interface was named “Diascope”. The “Diascope” program uses a logic channel management (abstract association of a control variable and an acquisition channel of the multiplexer), the average signal accumulation mechanism and other features that will be explained in the next paragraph. With the help of the “Diascope”, various signals from the system can be displayed on the monitor screen (e.g.: NMR echo/fid, varicap-piloting voltage, power generated by heaters, sensor temperature, magnet frequency, etc.). The physically acquired signal consists of the two components that are usually called the “real part” and the “imaginary part”. The two separate signals will be identified by two physical display channels, A and B (the physical display channels are not the same as the logic channels associated with the control variables). Signals are plotted on a grid whose reference axes are identified by the letters X (for abscissa) and Y (for ordinates).

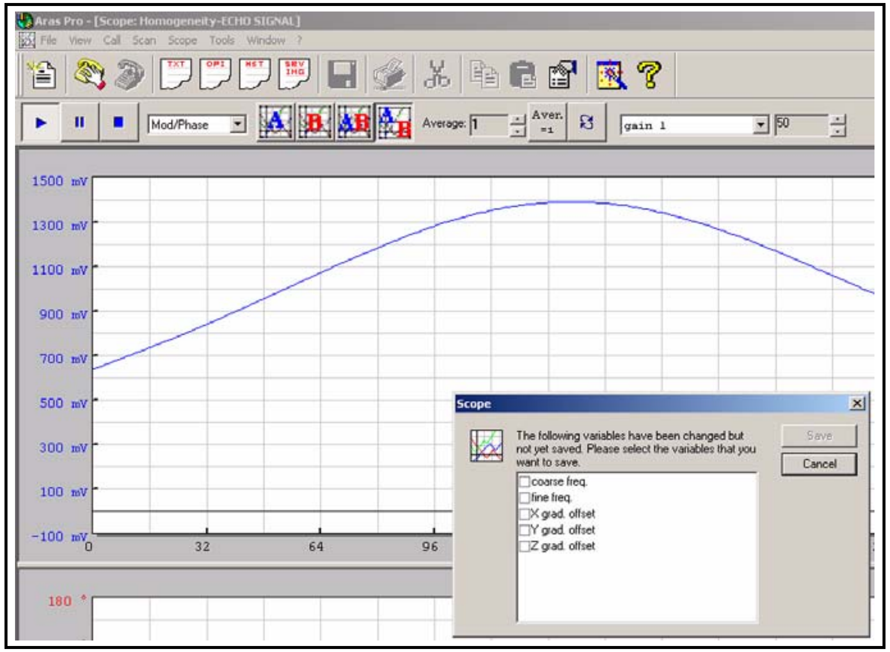
- Inside the selected test it's possible to scroll the available channels opening the small window like shown in the next figure

Fig. 203: Available channels



- To save the selected variable click on the **<Save>** icon (floppy)
- Click on the **<Stop>** icon (square) to quit from the test
- If you quit without saving the variables, the ARAS SW will ask you which calibrated variables you want to save: mark the corresponding box and click on the **<Save>** button

Fig. 204: Choose which variables you want to save

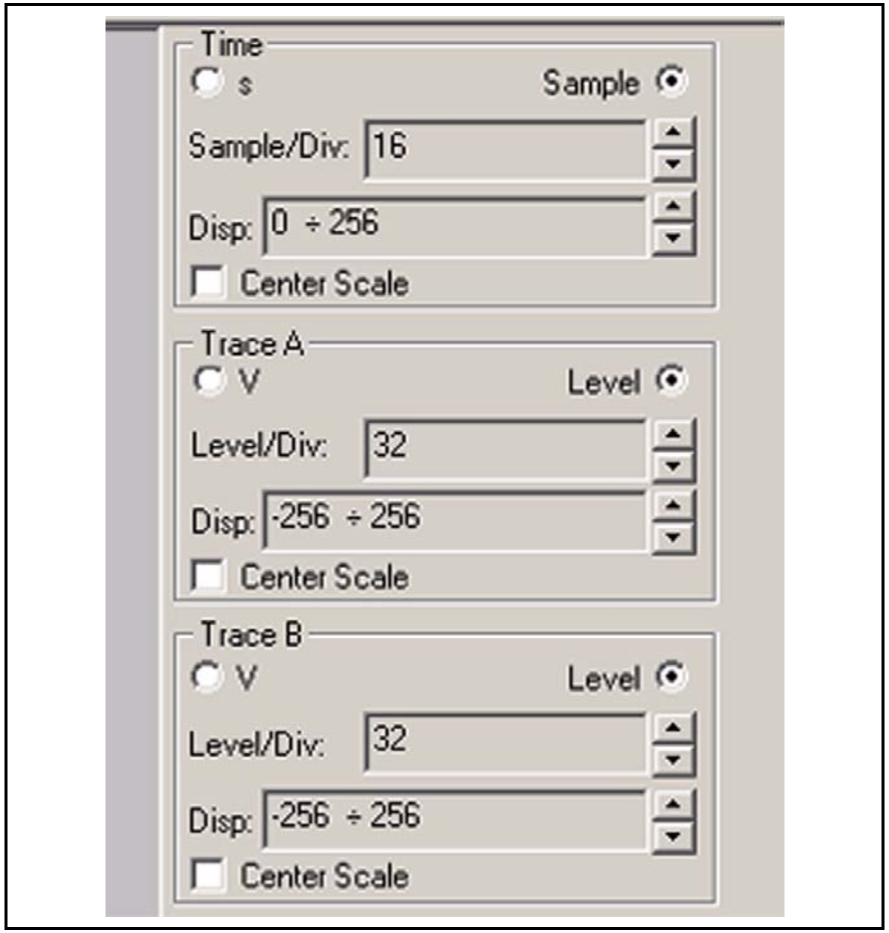


The following variables have been changed but not yet saved. Please select the variables that you want to save.

☐ coarse freq.
☐ fine freq.
☐ X grad. offset
☐ Y grad. offset
☐ Z grad. offset

- Like using an oscilloscope, it's possible to change some visualization settings acting on the right column of the ARAS window (refer to the next figure)

Fig. 205: Diascope settings



Time
○ s Sample ●
Sample/Div: 16
Disp: 0 ÷ 256
☐ Center Scale

Trace A
○ V Level ●
Level/Div: 32
Disp: -256 ÷ 256
☐ Center Scale

Trace B
○ V Level ●
Level/Div: 32
Disp: -256 ÷ 256
☐ Center Scale

- Other settings are available from the Scope toolbar

Tab. 6: ARAS Scope Buttons

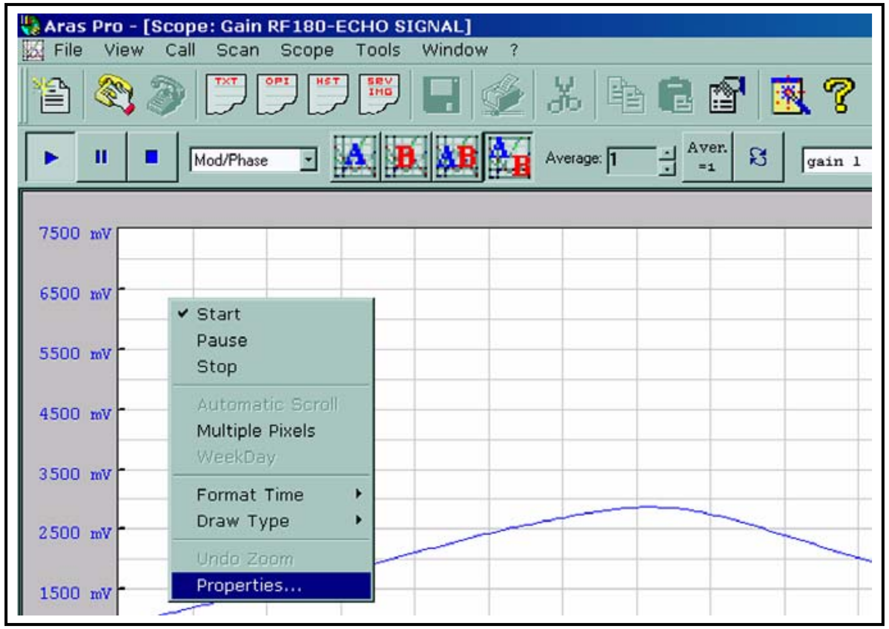
Icon	Function	Icon	Function
▶	Starts the acquisition	B	Shows only the B trace
⏸	Freezes the waveform	A B	Shows the A and B trace together
■	Stops the scope and exit	Average: 1	Average setting
Mod/Phase ▾	Diascope setting: modulo, echo or FFT	Aver. =1	Reset the average to 1
A	Shows only the A trace	↻	Restart the average acquisition

Personalize ARAS

It's possible to set and save your own ARAS settings.

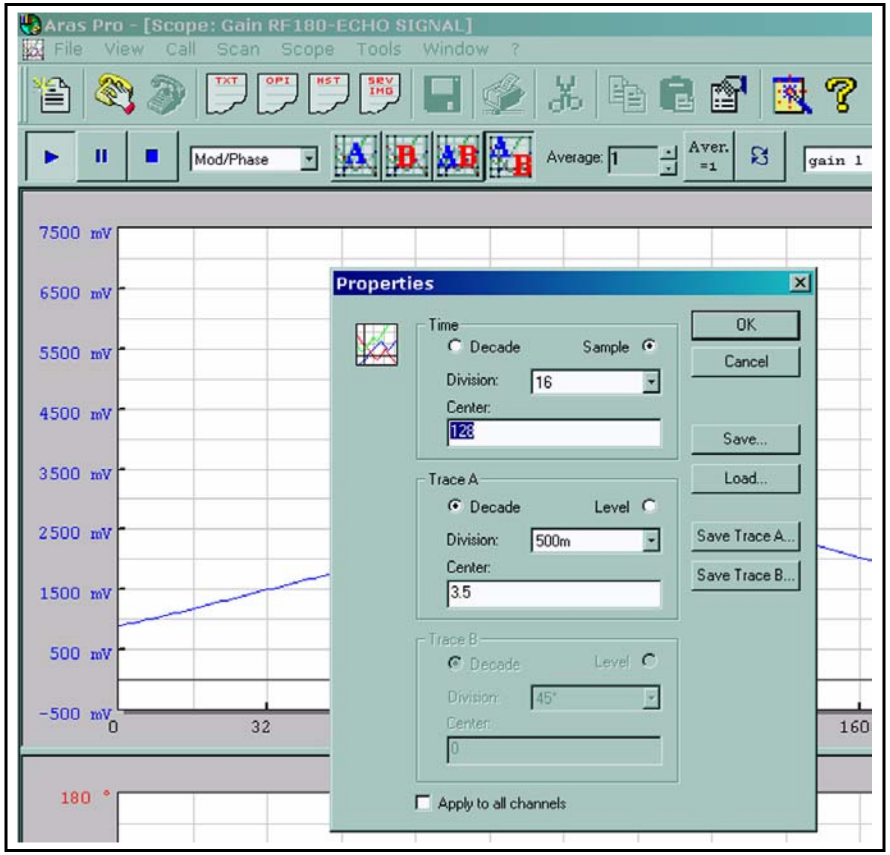
- When the test is running, click the right mouse button and the following menu will appear

Fig. 206: Right mouse button menu



- Select the **<Properties>** function then personalize and save your own default settings

Fig. 207: ***<Properties>*** *menu*



Time: ○ Decade ● Sample
Division: 16
Center: 128

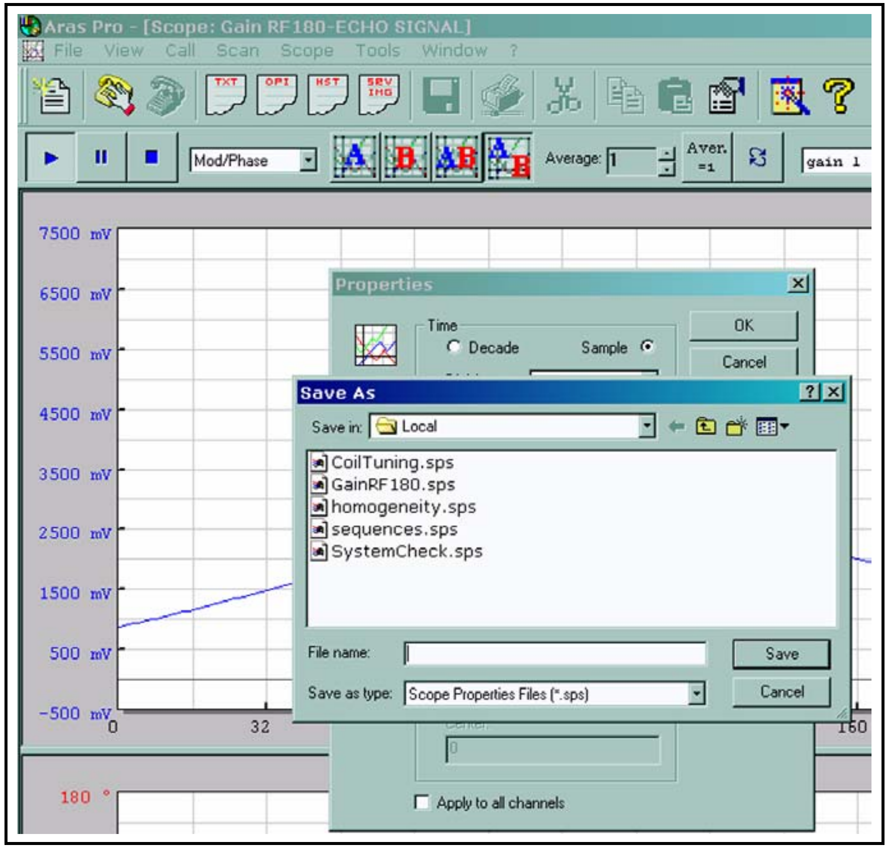
Trace A: ● Decade ○ Level
Division: 500m
Center: 3.5

Trace B: ● Decade ○ Level
Division: 45°
Center: 0

☐ Apply to all channels

- Click on the **<Save>** button then choose or create a new file from the following window

Fig. 208: Save or Load a file setting



Aras Pro - [Scope: Gain RF180-ECHO SIGNAL]

Mod/Phase

Average: 1

gain 1

Properties

Time: ○ Decade ● Sample

Save As

Save in: Local

CoilTuning.sps
GainRF180.sps
homogeneity.sps
sequences.sps
SystemCheck.sps

File name:

Save as type: Scope Properties Files (*.sps)

☐ Apply to all channels

Following the same procedure but selecting **<Load>**, instead of **<Save>** in the previous menu, it's possible to load your own settings

Internet Explorer Features

Launching Internet Exploring from the PC desktop and logging the user like SERV, the service technician can access to some system settings and system information.

The system automatically opens the Service Homepage and the entire menu is shown in the next image.

Using Explorer it's possible to set the system name and others system data.

The following figures show all the Explorer menus starting from the homepage.

NOTICE Launching IE, the program asks you to "Work offline or Try Again", select always "Try Again" otherwise the program doesn't allow you to modify and save any parameter field

---

NOTICE If modifying the System Date same buttons disappear, click on the refresh button

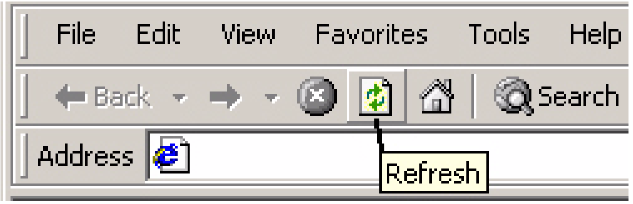


Fig. 209: Explorer Service Menu

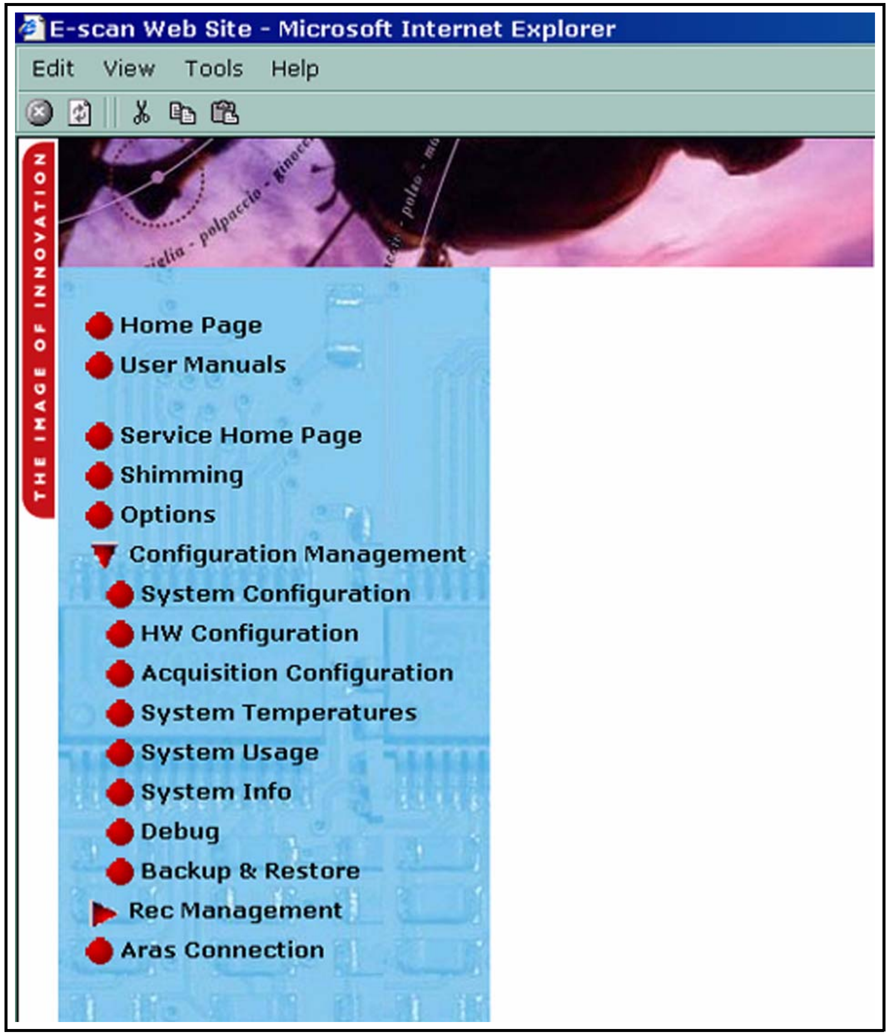
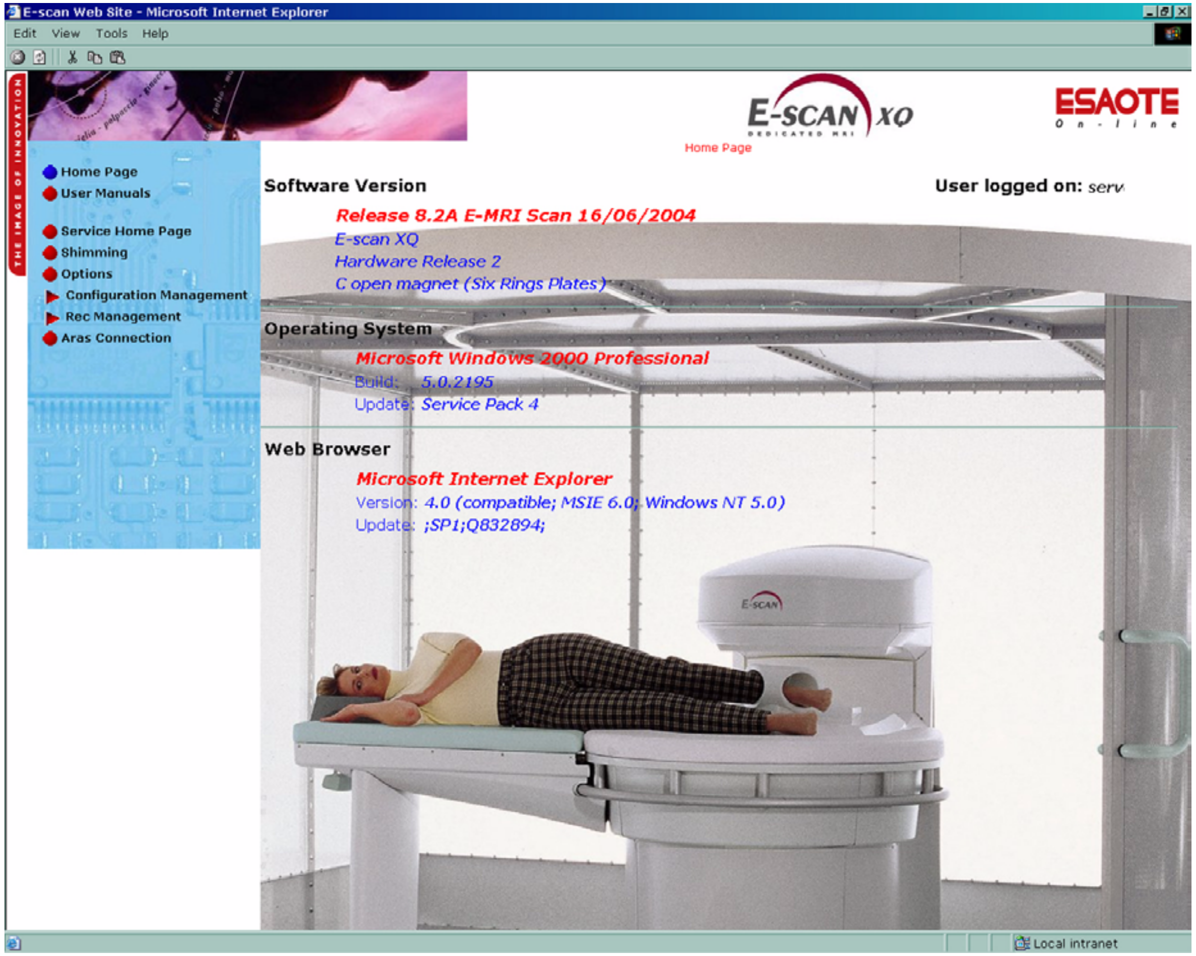


Fig. 210: Home Page



Software Version

User logged on: serv

Release 8.2A E-MRI Scan 16/06/2004

E-scan XQ

Hardware Release 2

C open magnet (Six Rings Plates)

Operating System

Microsoft Windows 2000 Professional

Build: *5.0.2195*

Update: *Service Pack 4*

Web Browser

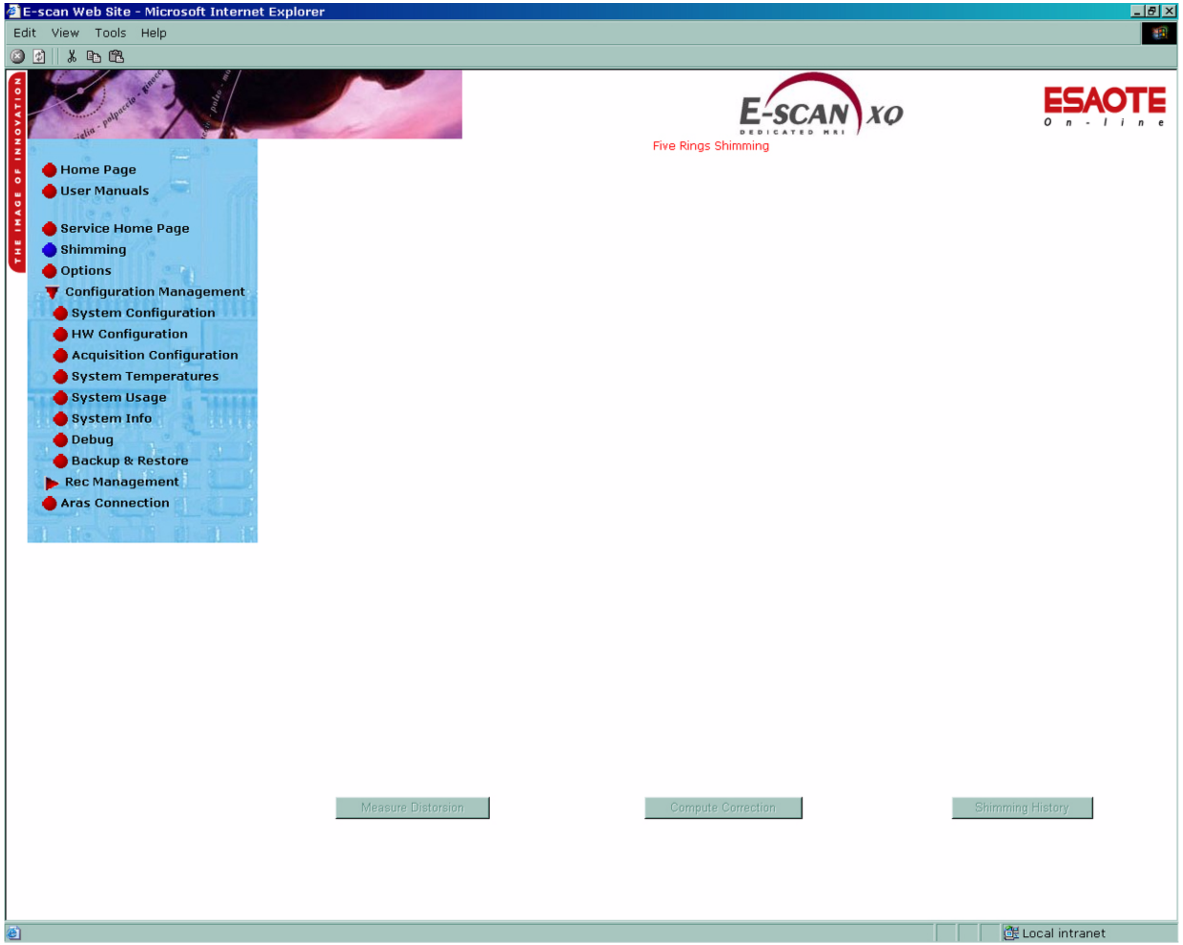
Microsoft Internet Explorer

Version: *4.0 (compatible; MSIE 6.0; Windows NT 5.0)*

Update: *;SP1;Q832894;*

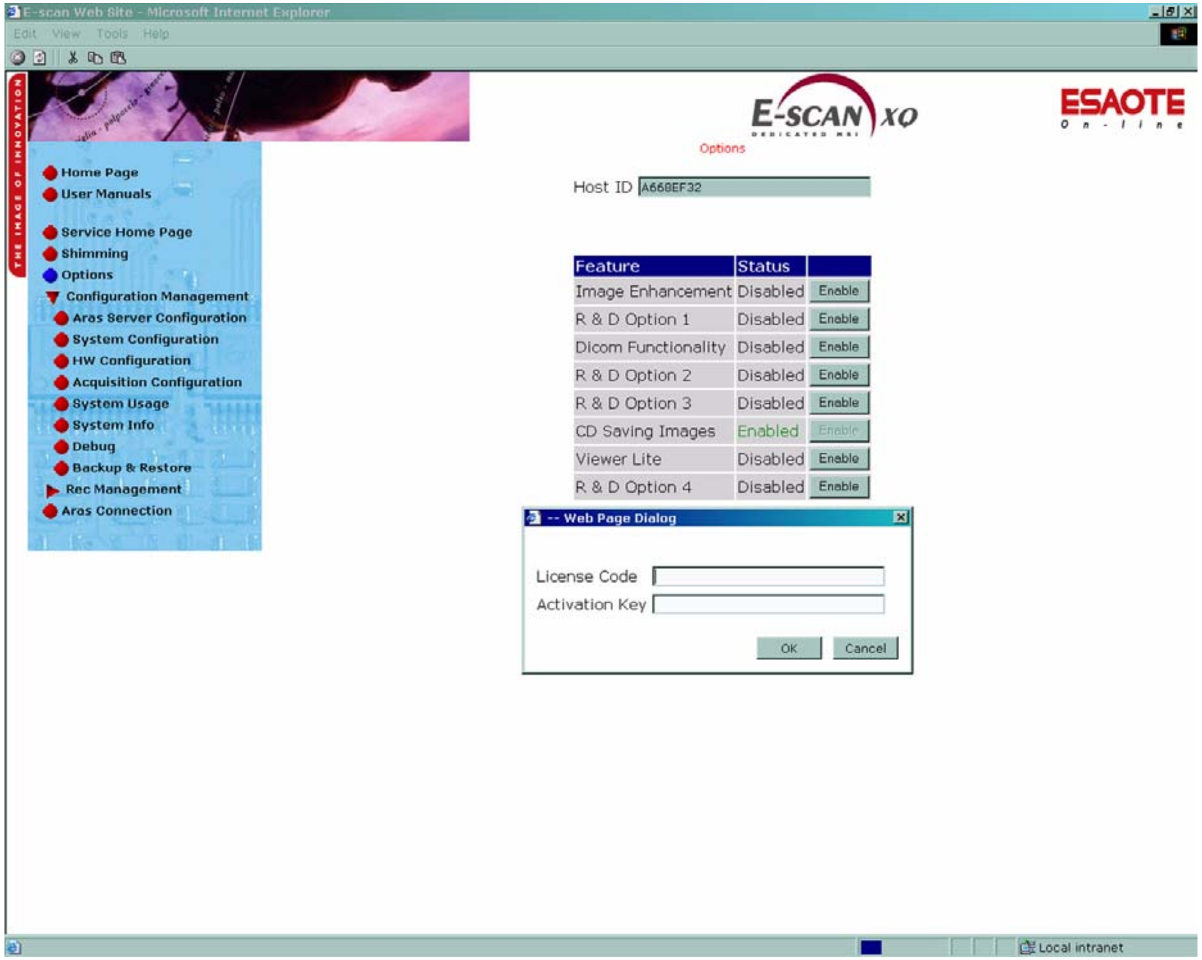
This page allows to check the SW settings related to the System electronic type and the version of the web browser installed.

Fig. 211: Shimming Page



This page allow to perform the Shimming Parameter calculation and correction.

Fig. 212: Option Page



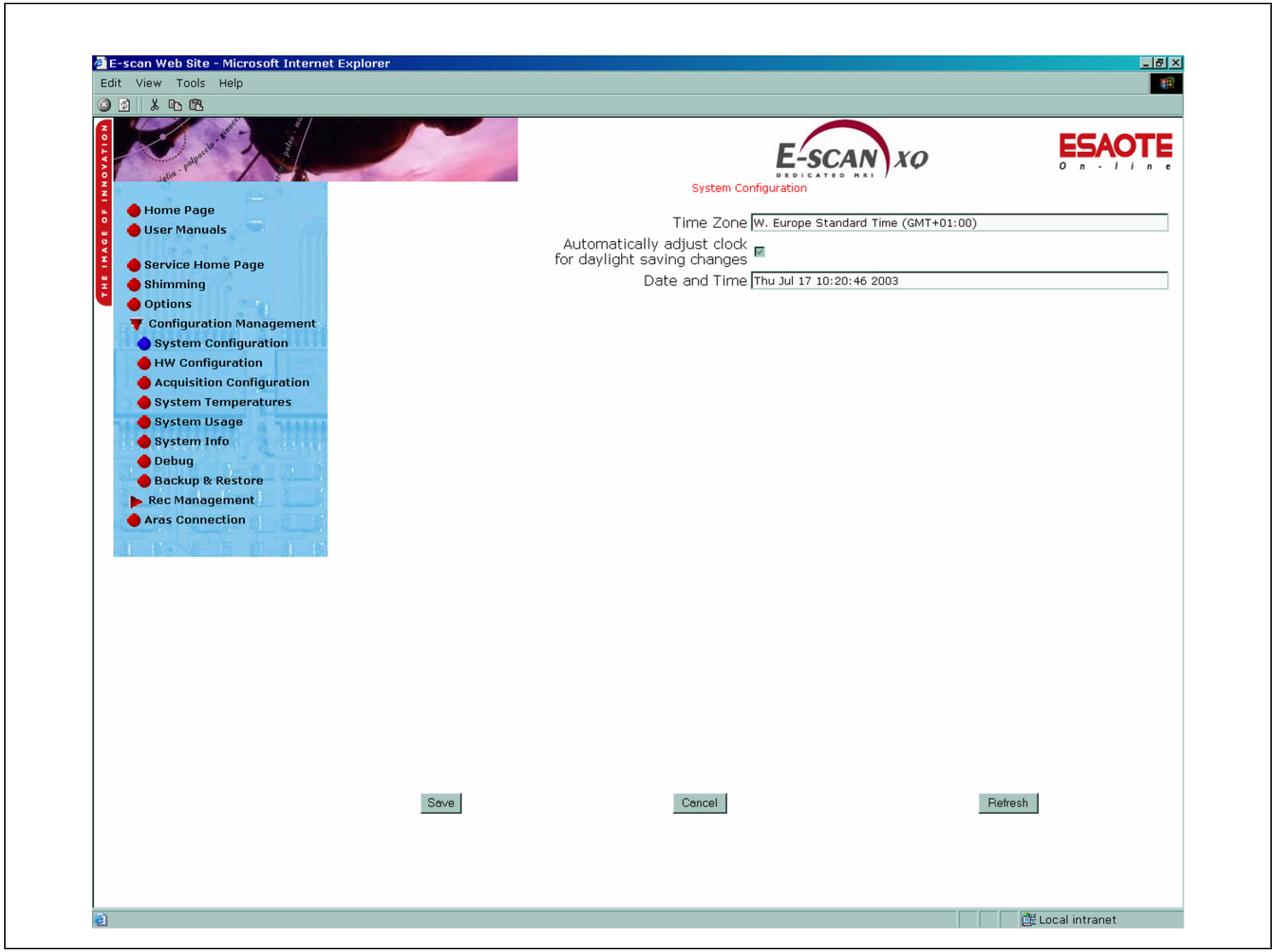
Host ID A668EF32

Feature	Status	
Image Enhancement	Disabled	Enable
R & D Option 1	Disabled	Enable
Dicom Functionality	Disabled	Enable
R & D Option 2	Disabled	Enable
R & D Option 3	Disabled	Enable
CD Saving Images	Enabled	Enable
Viewer Lite	Disabled	Enable
R & D Option 4	Disabled	Enable

License Code
Activation Key

This page allow the Service Technician to enable the System Option inserting the correct code.

Fig. 213: System Configuration



System Configuration

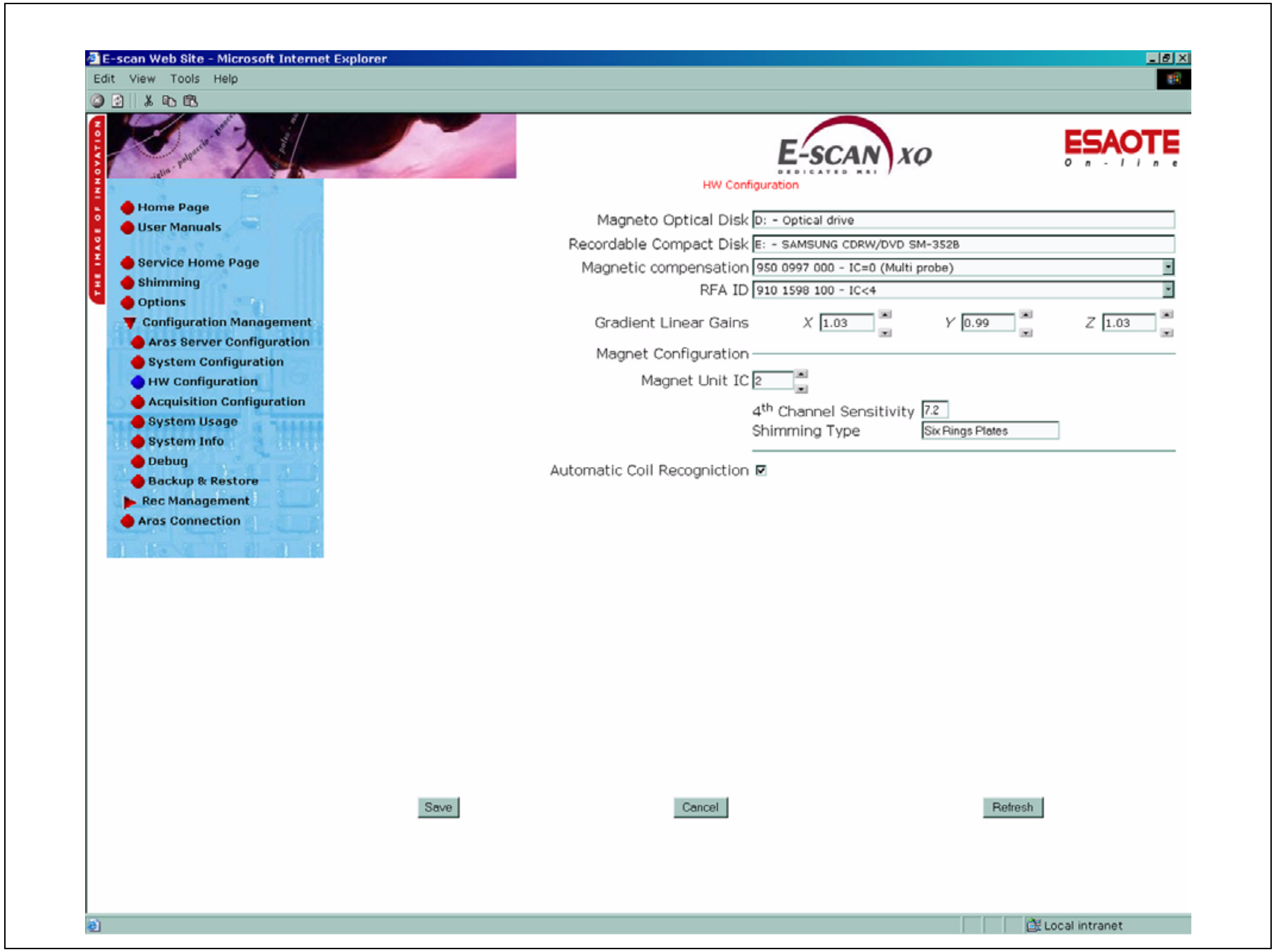
Time Zone: W. Europe Standard Time (GMT+01:00)

Automatically adjust clock for daylight saving changes ☑

Date and Time: Thu Jul 17 10:20:46 2003

This page allows to set the time zone, automatic clock adjustment and date and time.

Fig. 214: Hardware Configuration Page



HW Configuration

Magneto Optical Disk: D: - Optical drive
Recordable Compact Disk: E: - SAMSUNG CDRW/DVD SM-352B
Magnetic compensation: 950 0997 000 - IC=0 (Multi probe)
RFA ID: 910 1598 100 - IC<4
Gradient Linear Gains: X 1.03 Y 0.99 Z 1.03

Magnet Configuration
Magnet Unit IC: 2
4th Channel Sensitivity: 7.2
Shimming Type: Six Rings Plates

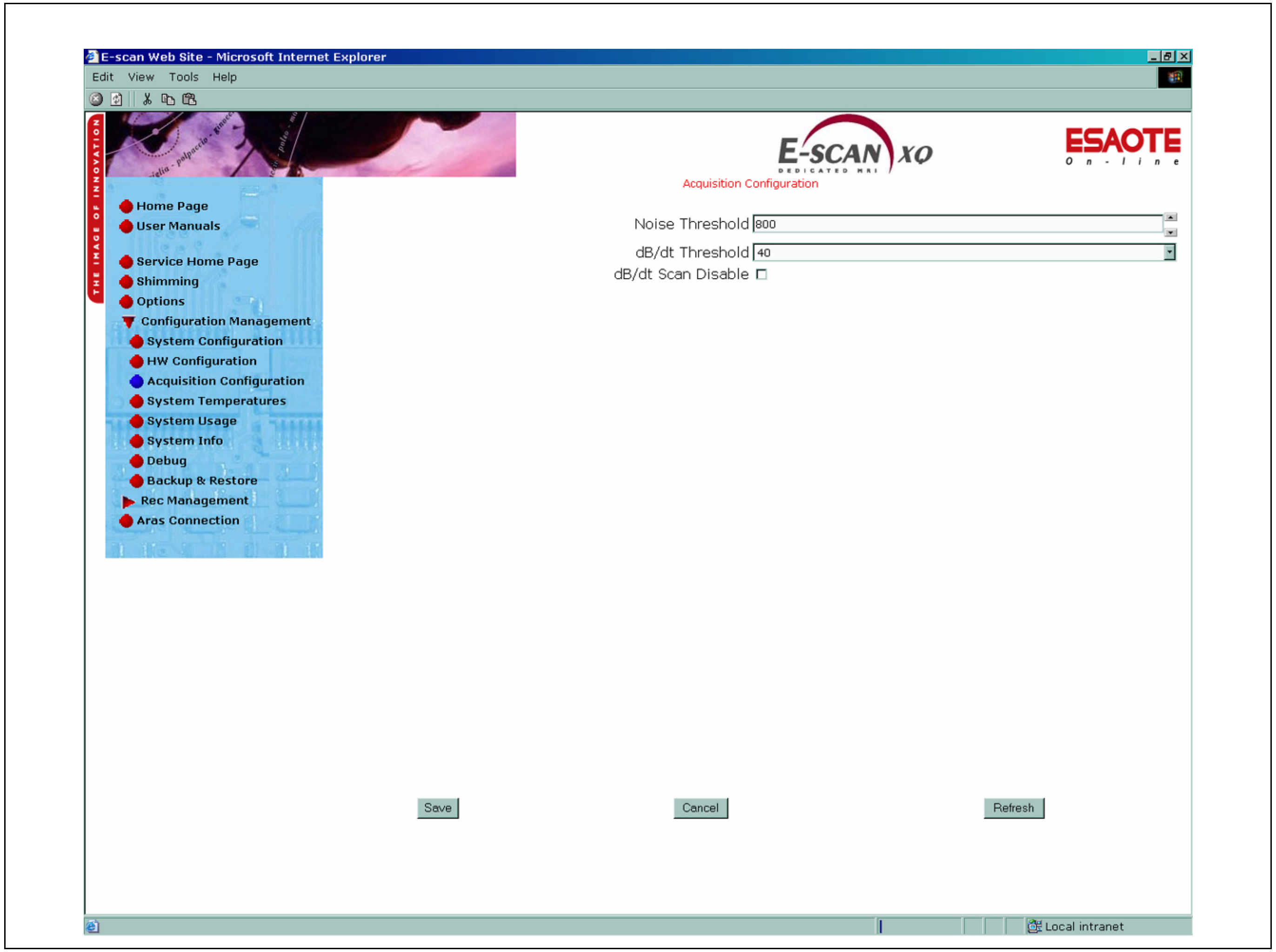
Automatic Coil Recogniction ☑

From this page it's possible to set the system connect devices (e.g.: ODD, CD burner, etc.), the system flags (e.g.: MAGC ID, RFA ID, etc.), the IV CH and the Gradient Linear Gains (Geometrical Distortion Test).

The new magnets have the shimming plates with six rings (carbon fiber plates) instead of five rings (plastic plates). The Magnet Type flag allows this setting to correctly apply the Shimming correction procedure.

A new RFA module has been introduced as well.

Fig. 215: Acquisition Configuration Page



Acquisition Configuration

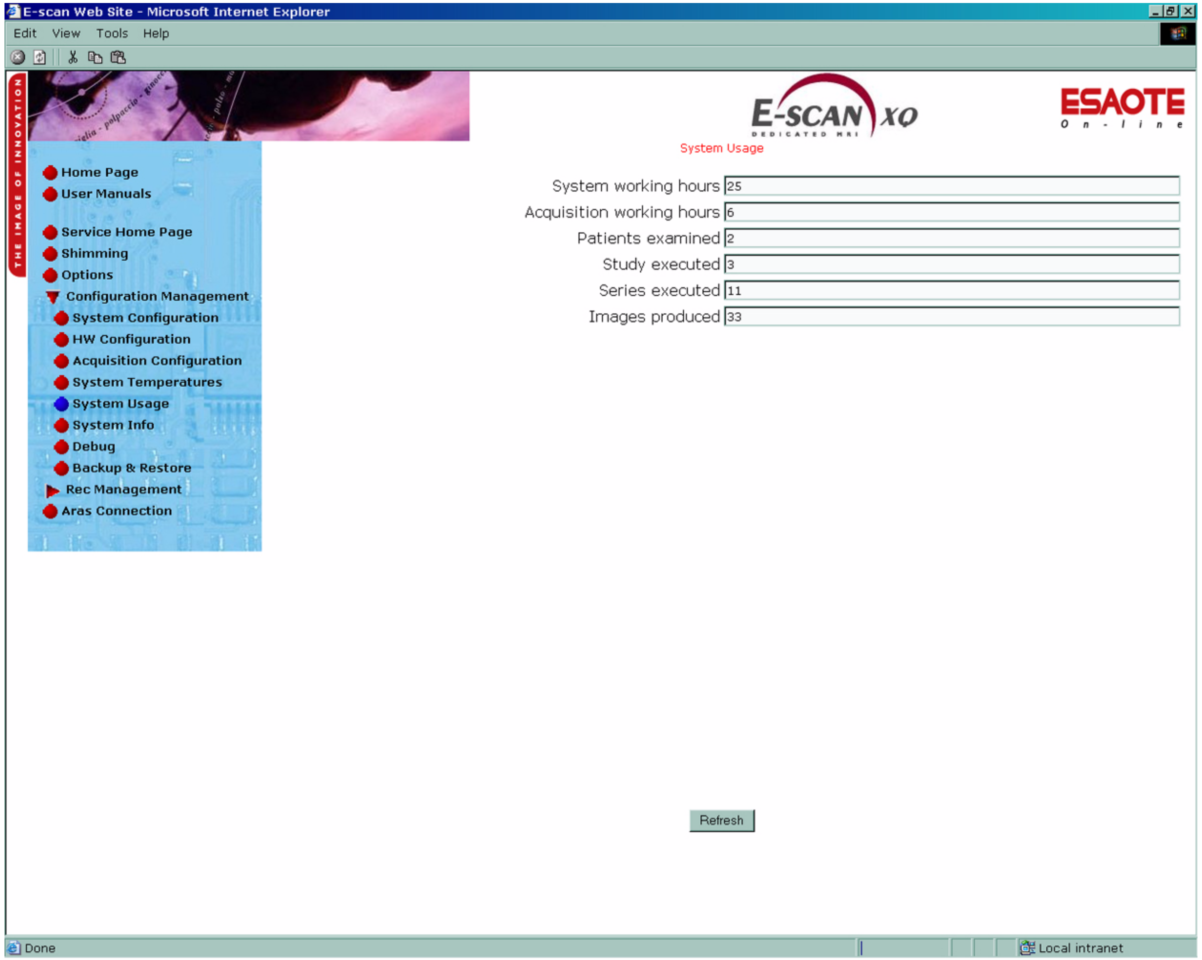
Noise Threshold 800

dB/dt Threshold 40

dB/dt Scan Disable ☐

This page allows to set the Noise Threshold and the dB/dt ratio threshold.

Fig. 216: System Usage



System Usage

System working hours 25

Acquisition working hours 6

Patients examined 2

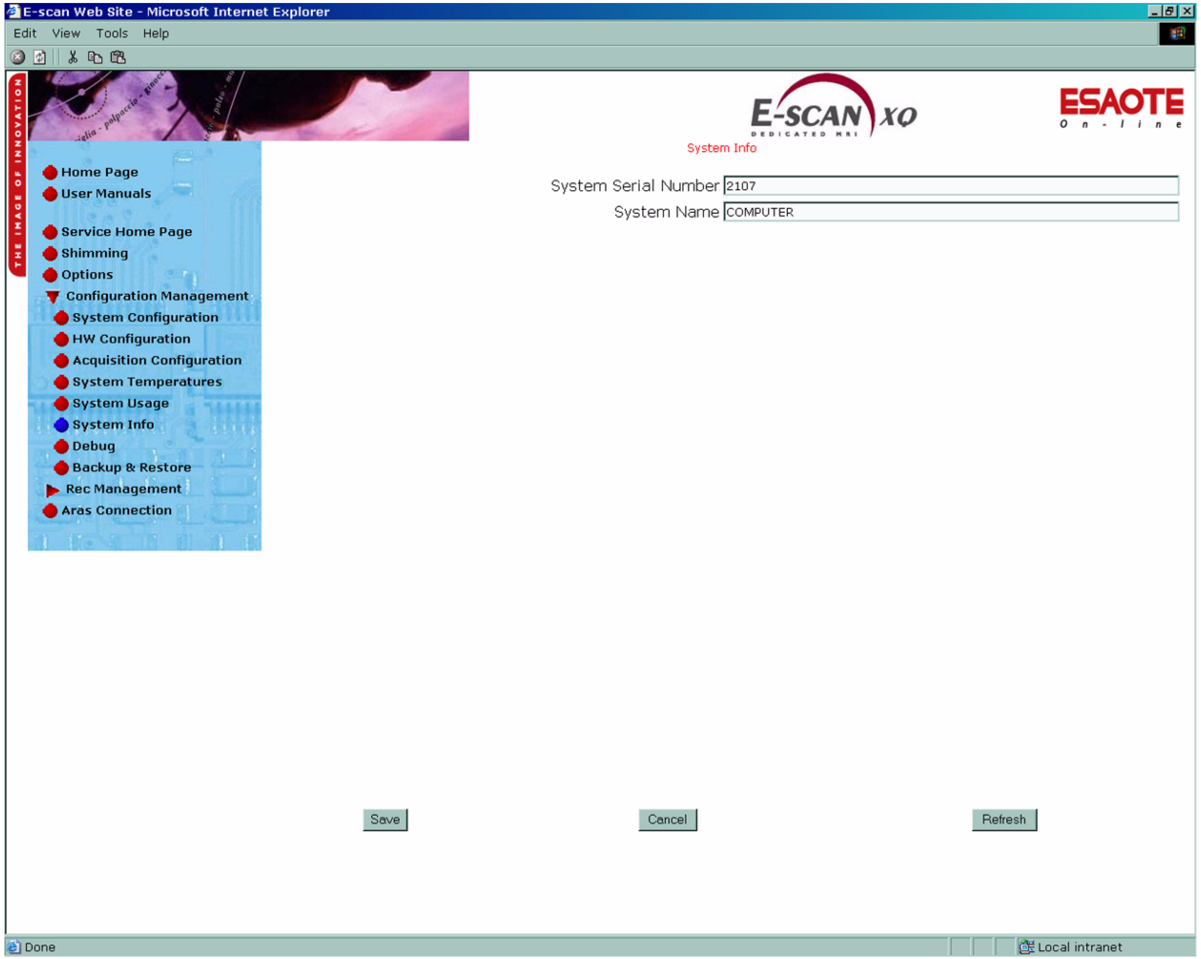
Study executed 3

Series executed 11

Images produced 33

This page allows to set or read system data like working hours, number of examined patients, number of acquired study, executed series and images.

Fig. 217: System Info



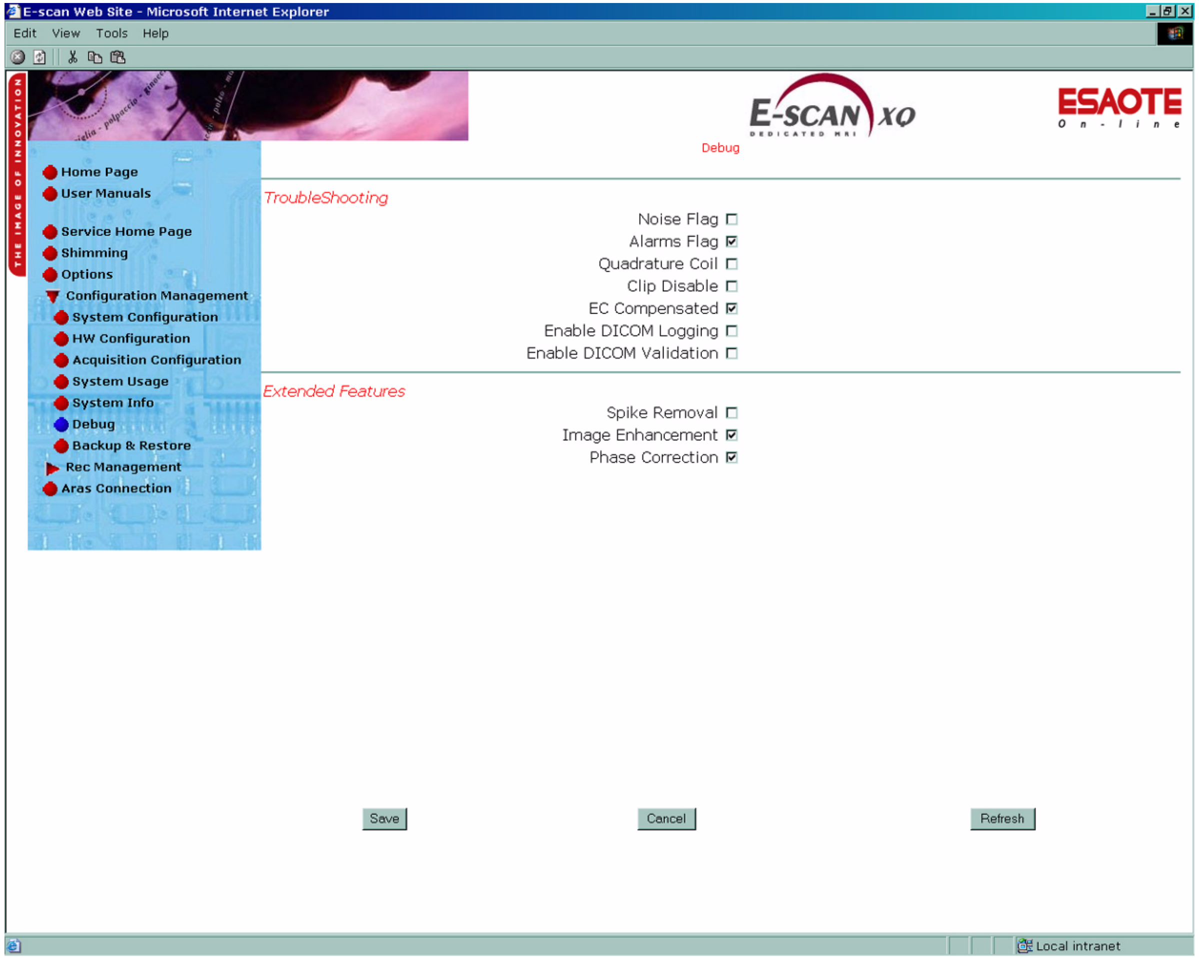
System Serial Number 2107
System Name COMPUTER

This page allows to set the system serial number, system name, institute and department names.

The maximum acceptable number of characters in the System Name field is 16, in the Institute Description field is 256 and in the department Description is 256.

If the System Serial Number is modified, the System must be rebooted.

Fig. 218: Debug



Debug

TroubleShooting

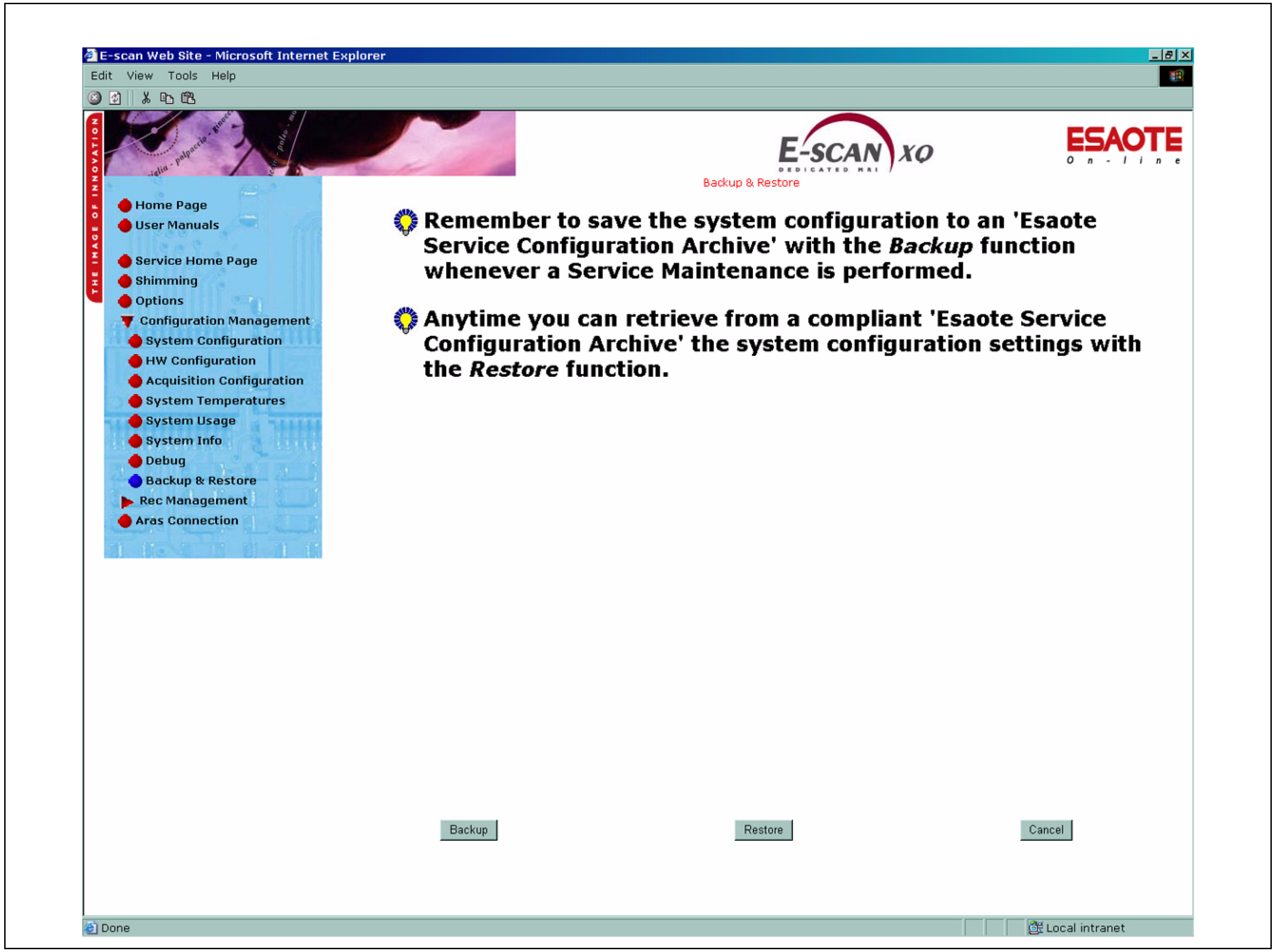
Noise Flag ☐
Alarms Flag ☑
Quadrature Coil ☐
Clip Disable ☐
EC Compensated ☑
Enable DICOM Logging ☐
Enable DICOM Validation ☐

Extended Features

Spike Removal ☐
Image Enhancement ☑
Phase Correction ☑

This page allows to set the debug of the system: noise flag, alarms flag, quadrature coil, raw data flag, clip disable and spike removal.

Fig. 219: Configuration Restore and Back-up

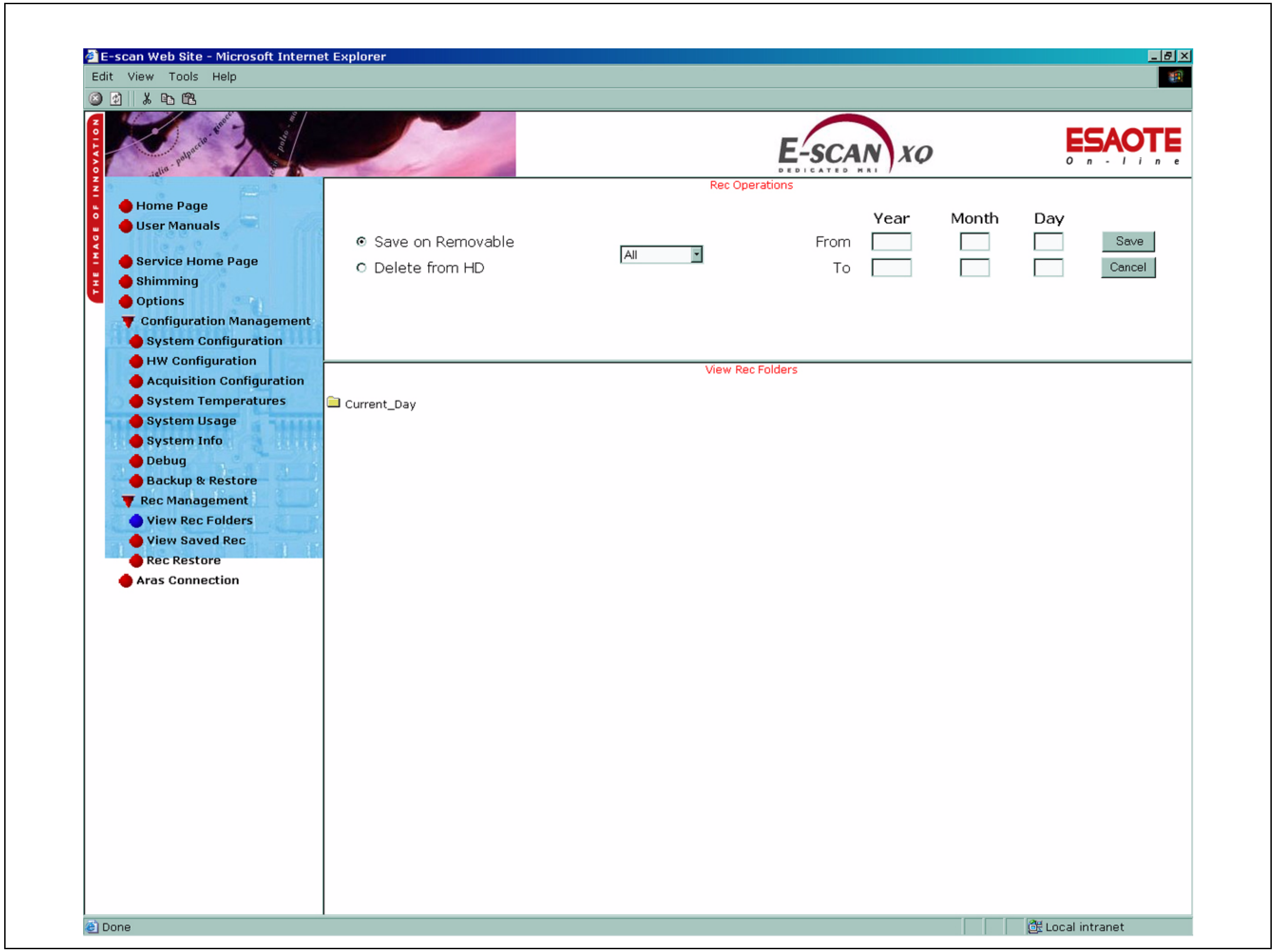


Remember to save the system configuration to an 'Esaote Service Configuration Archive' with the *Backup* function whenever a Service Maintenance is performed.

Anytime you can retrieve from a compliant 'Esaote Service Configuration Archive' the system configuration settings with the *Restore* function.

This page allows to create the system software back-up and to restore it.

Fig. 220: View Rec Folders



Rec Operations

● Save on Removable
○ Delete from HD

All

	Year	Month	Day
From			
To			

View Rec Folders

Current_Day

This page allows the service people to save the Service Images contained into the folder C:\Nmr\Rec\… and read and save the system REC files.

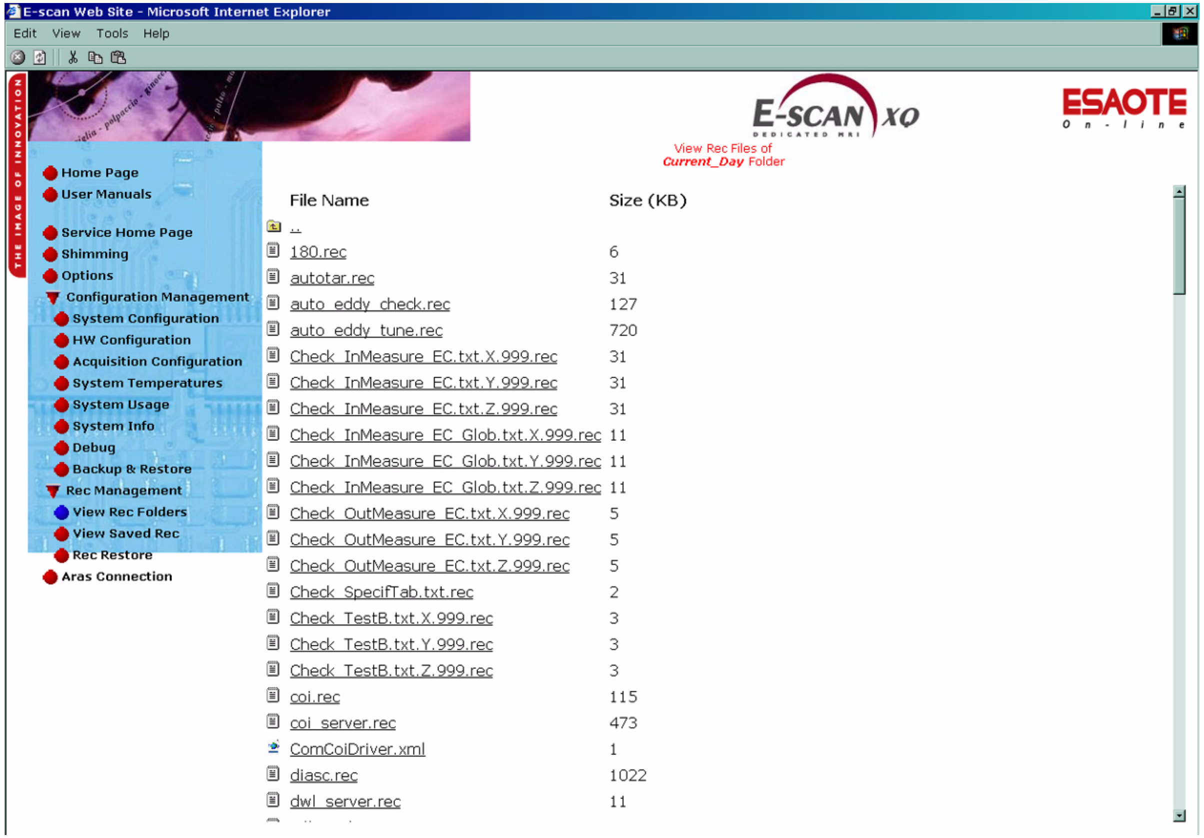
The rec files contain all the operations performed by the system. Some of them are generic other are more specific. The system creates a new folder every day and every folder contain only the rec files filled in that day.

When the maximum fixed dimension is reached the oldest data are erased by the newest.

To save the Service Images, it's necessary to select the **All** function, insert an empty optical cartridge and press the <**Save**> button.

Selecting the others option (**Interval** or **Current Day**) only the Rec files are saved.

Fig. 221: Contents of one Day folders



View Rec Files of
Current_Day Folder

File Name	Size (KB)
..	
180.rec	6
autotar.rec	31
auto_eddy_check.rec	127
auto_eddy_tune.rec	720
Check_InMeasure_EC.txt.X.999.rec	31
Check_InMeasure_EC.txt.Y.999.rec	31
Check_InMeasure_EC.txt.Z.999.rec	31
Check_InMeasure_EC_Glob.txt.X.999.rec	11
Check_InMeasure_EC_Glob.txt.Y.999.rec	11
Check_InMeasure_EC_Glob.txt.Z.999.rec	11
Check_OutMeasure_EC.txt.X.999.rec	5
Check_OutMeasure_EC.txt.Y.999.rec	5
Check_OutMeasure_EC.txt.Z.999.rec	5
Check_SpecifTab.txt.rec	2
Check_TestB.txt.X.999.rec	3
Check_TestB.txt.Y.999.rec	3
Check_TestB.txt.Z.999.rec	3
coi.rec	115
coi_server.rec	473
ComCoiDriver.xml	1
diasc.rec	1022
dwl_server.rec	11

This is the content of one rec file folder. Select the “name”.rec file to visualize the contained information.

Visual Inspection Checks

Outside Marking Checks

Check the System Serial Number Label placed under the Electronic Unit Switch as follows:

- Name and address of manufacturer
- Product part number
- Product serial number
- Report the test results on the Installation and Quality Form

Cover and Mechanical Component Checks

Check as follows:

- Integrity of the System covers
- Rotation and translation and wheel brakes of the Patient Table
- Integrity of Patient Table padding
- Coil rotation mechanism of the receiving coils
- Cable extension mechanism of the Patient Table
- Report the test results on the Installation and Quality Form

Cable Connection Checks

Check as follows:

- tightness of terminal screws of the protective earth connection cable (figure shown in the Cabling and Grounding paragraph) between:
  - the magnetic unit and the filter panel
  - the electronics box and the PC unit
- settings and tightness of every connectors.
- tightness of fastening screws of each electronic module
- Report the test results on the Installation and Quality Form

Calibration Procedures

Calibrations and quality tests must be performed on all four coils supplied. More specifically, all the procedures described below must be performed for the knee coil (number 2), whereas a subset will be sufficient for the other coils. For this reason, we will refer by default to the knee coil.

The calibrations flow-chart illustrates the logical calibration steps shown in the following pages. Calibrations and quality tests must be performed on all four coils supplied. More specifically, all the procedures described below must be performed for the Knee Coil (number 1), whereas a subset will be sufficient for the other coils. For this reason, we will refer by default to the Knee Coil 2.

The calibrations flow-chart illustrates the logical calibration steps shown in the following pages.

⚠**WARNING** **All the automatic calibration save the found value/s except the Coil Tuning and the 180 Pulse calibrations!!!**

CAUTION **To work with ARAS (e.g.: to calibrate the system) the ARAS Connection page inside Internet Explorer program must be open!!!**

NOTICE The result of all the Automatic calibration is a window message: scroll the answer to read all the found values!!!

Phantoms

The phantoms are supplied with each machine, namely three homogenous phantoms (two spherical and one bottle), one geometrical phantom and one ghost phantom (visible in the Ghost Test paragraph). A big bottle, made in soft plastic, is provided to fill the other phantoms to avoid physical break due to very low temperature.

The geometrical phantom, used to check image characteristics, consists of a 50 mm high Plexiglas cylinder, having an internal diameter of 100 mm and containing some objects at specific locations. Specifically, it contains two triangular prisms for evaluating the slice thickness and position, a 1-mm resolution pattern and geometrical reference pins.

Three homogenous phantoms consist of one cylindrical container (bottles), having diameters 74 mm, to be used with hand coil and two spherical phantom having diameter 86 mm and 140 mm, to be used respectively for calibration and quality test (signal to noise and uniformity). They are filled with an aqueous solution of 5 mM of $NiCl_2$ and 55 mM of NaCl.

In the next figure the AXIAL, SAGITAL and CORONAL geometrical phantom positions are shown.

Fig. 222: Geometrical phantom in AXIAL position

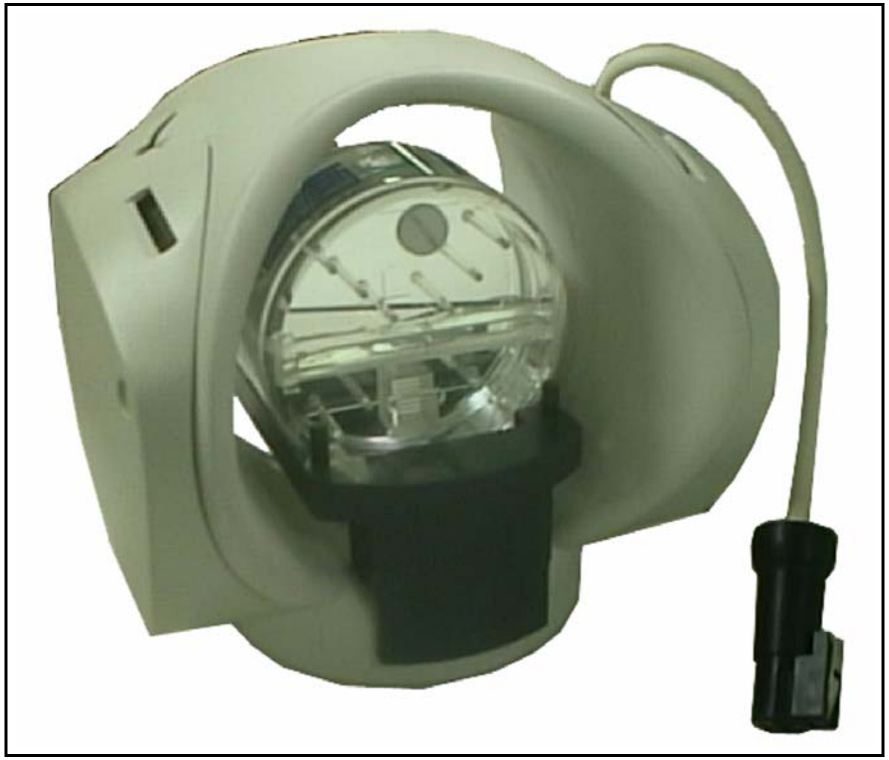


Fig. 223: Geometrical phantom in SAGITTAL position

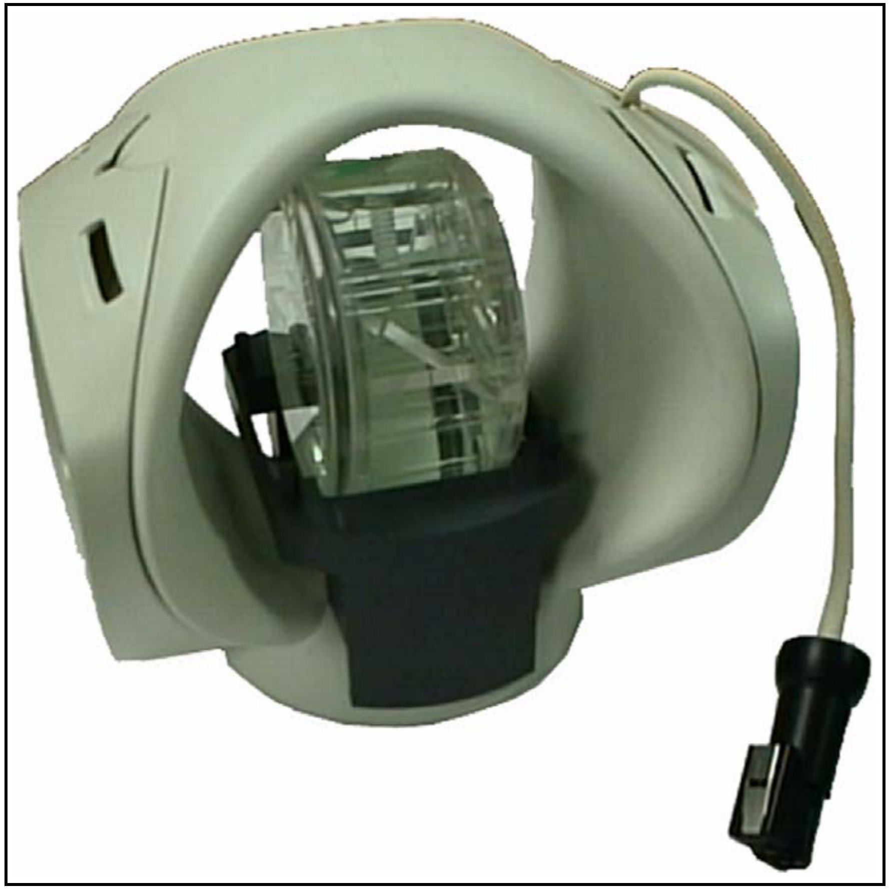


Fig. 224: Geometrical phantom in CORONAL position

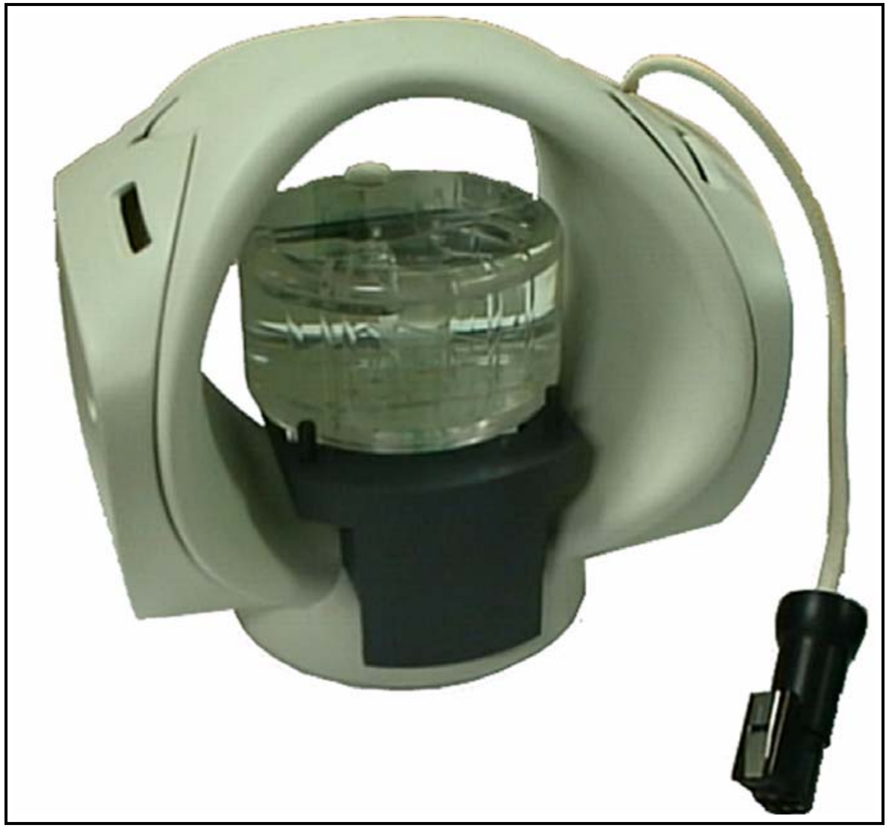


Fig. 225: Geometrical phantom in AXIAL position inside the magnet

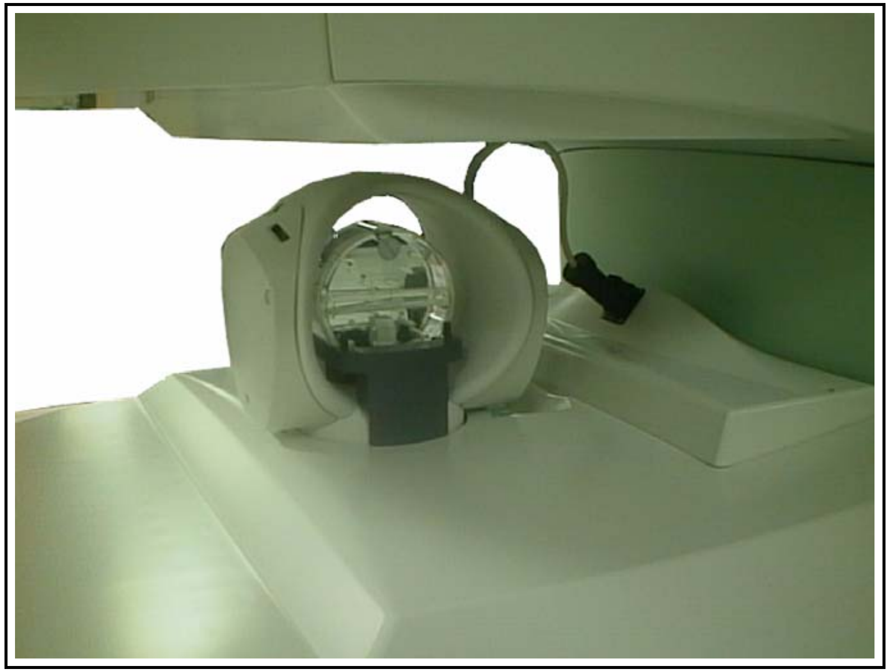


Fig. 226: Shoulder Coil and Large Spherical Phantom for Calibration

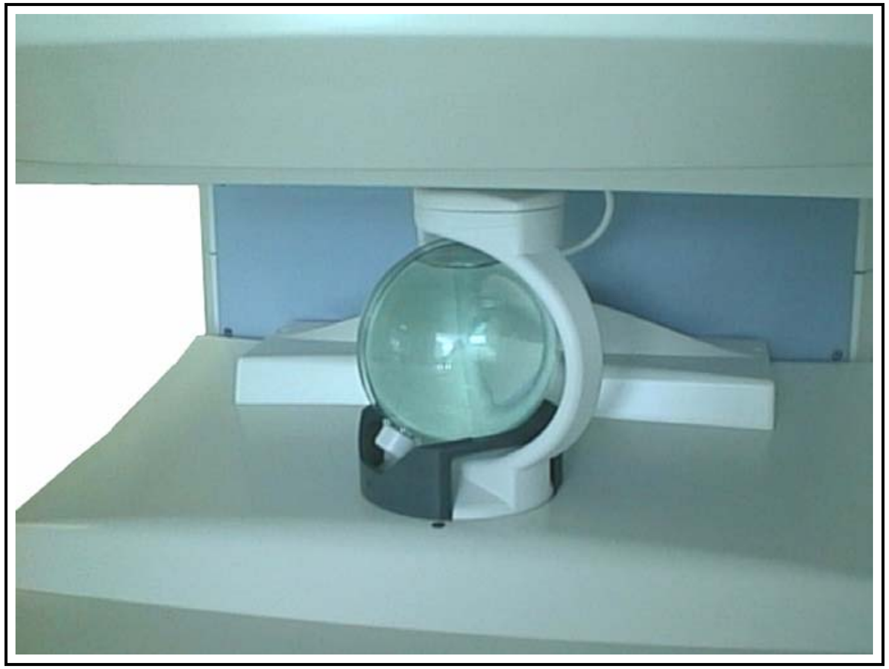


Fig. 227: Shoulder Coil and Large Spherical Phantom for Quality Test

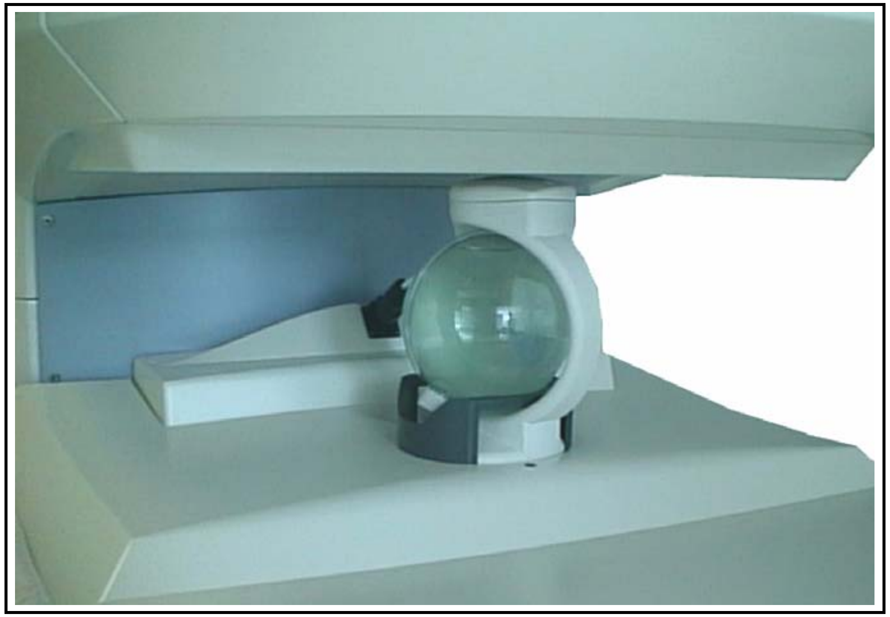


Fig. 228: Hand Coil and Bottle Phantom

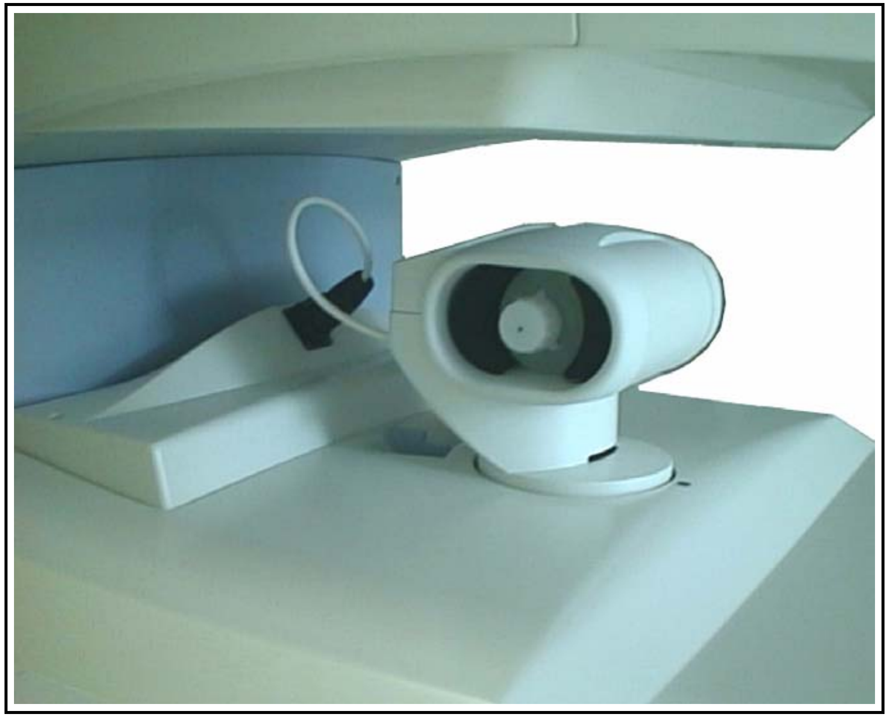


Fig. 229: Ankle Coil and Bottle Phantom

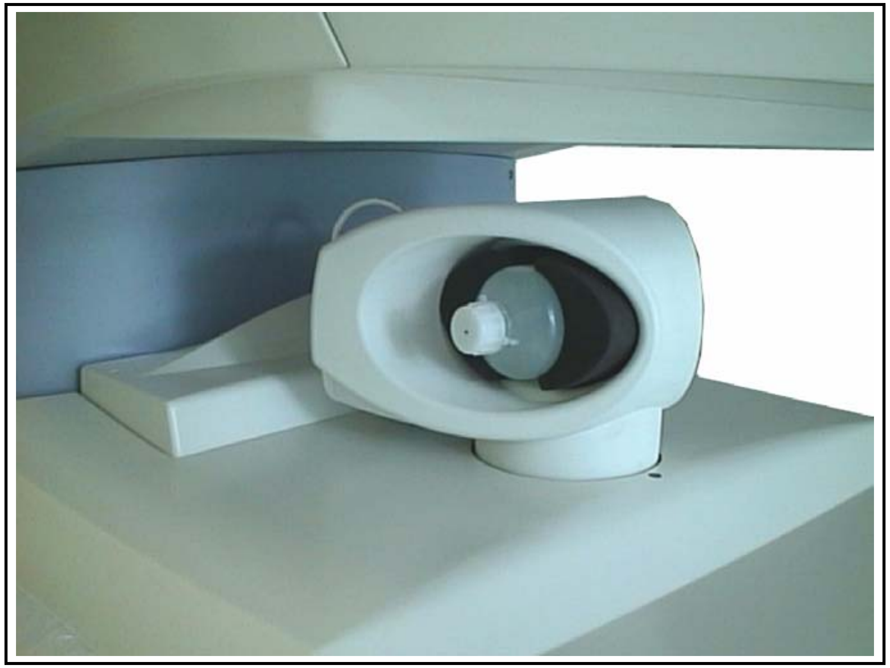


Fig. 230: Shoulder Coil 5 and Bottle Phantom for Calibration

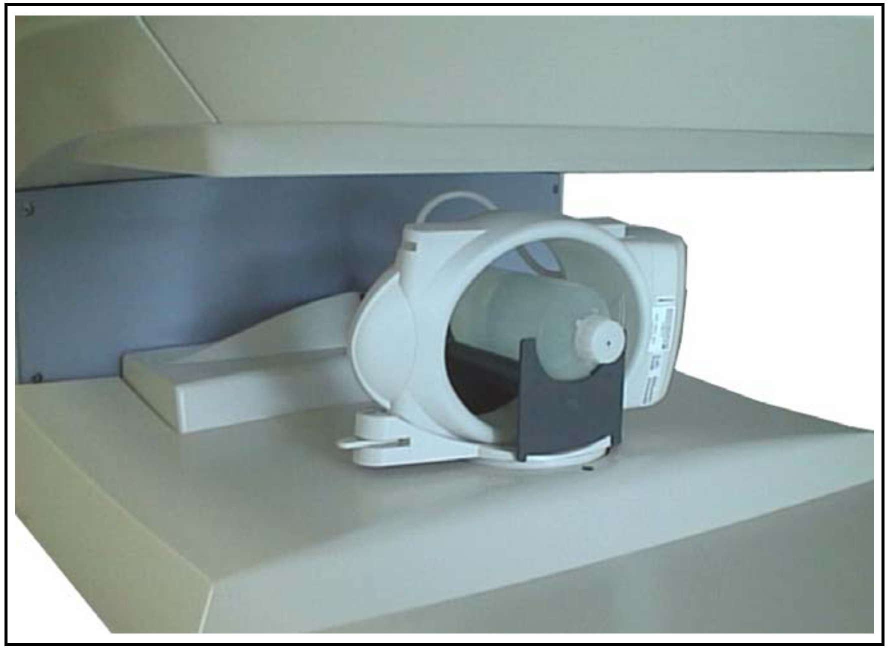


Fig. 231: Shoulder Coil 5 and Bottle Phantom for Quality Test

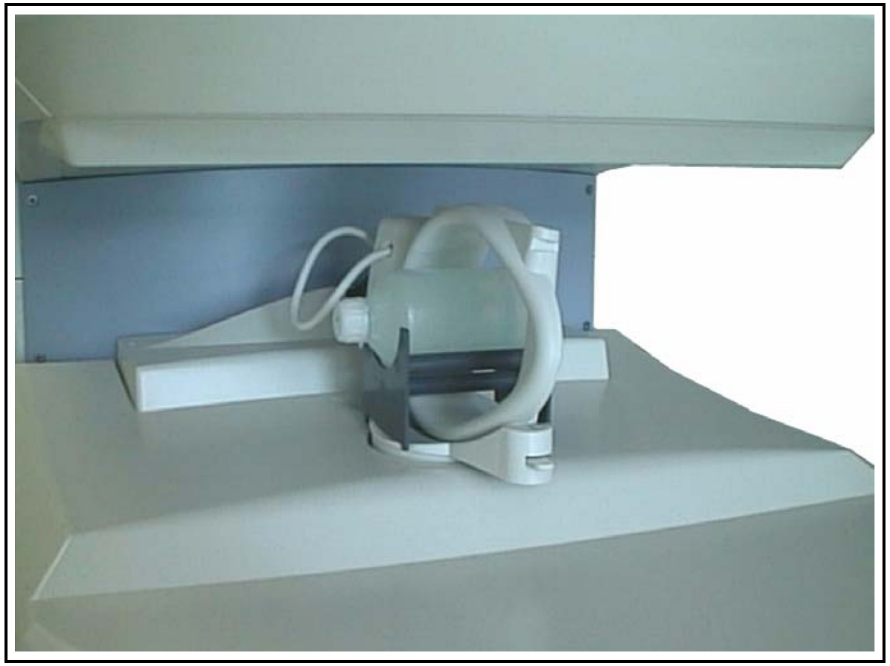


Fig. 232: Flex Coil

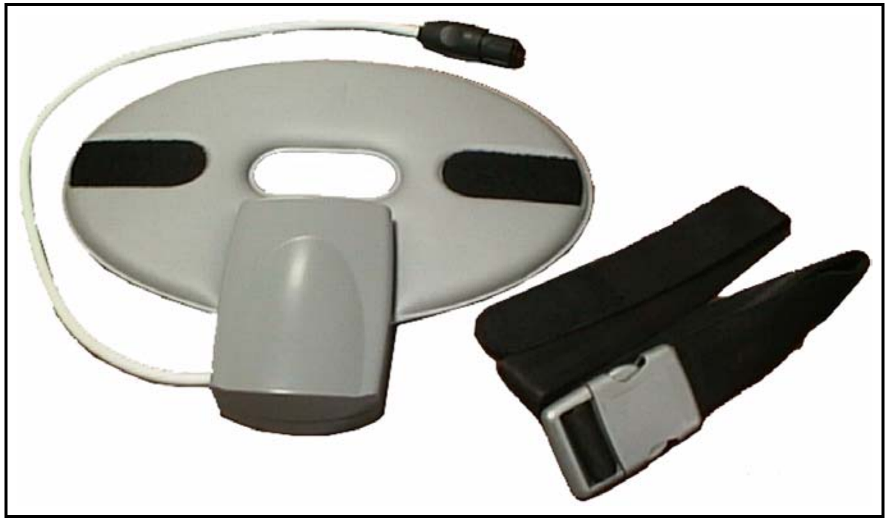


Fig. 233: Flex Coil Phantom and Holders

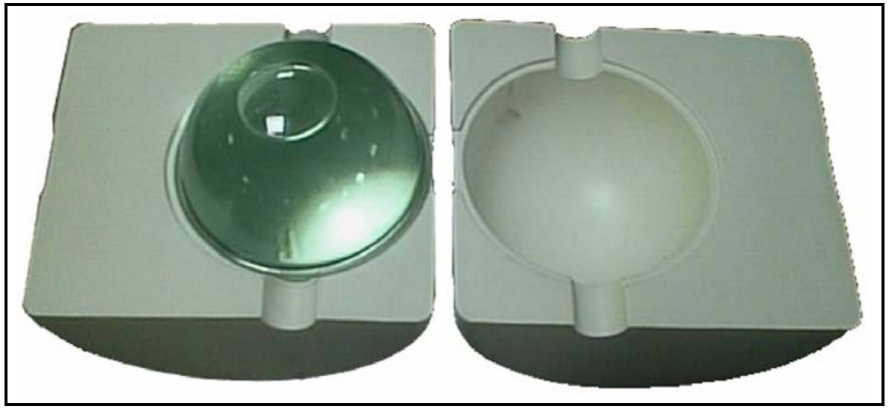


Fig. 234: Flex Coil Tuning Position

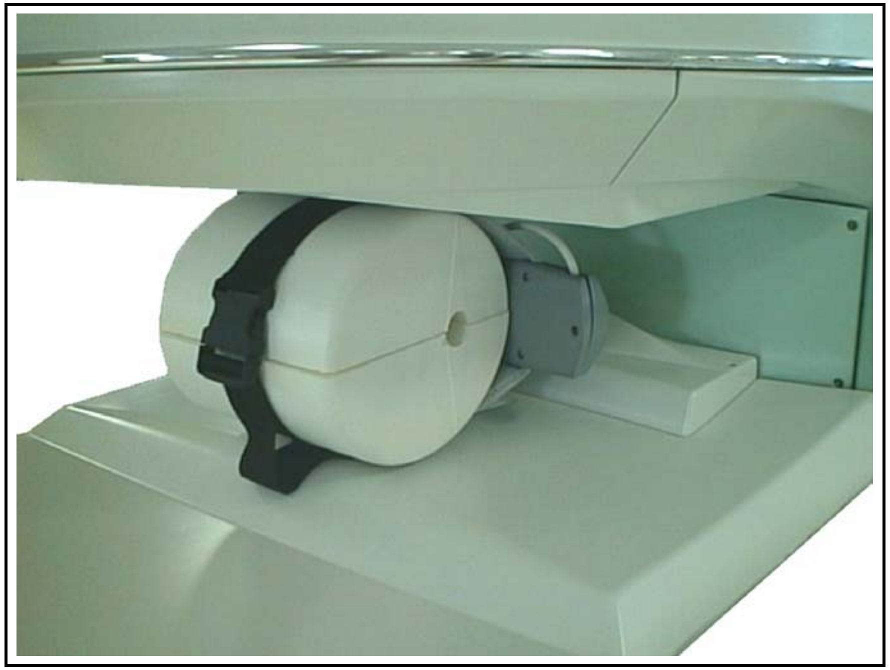
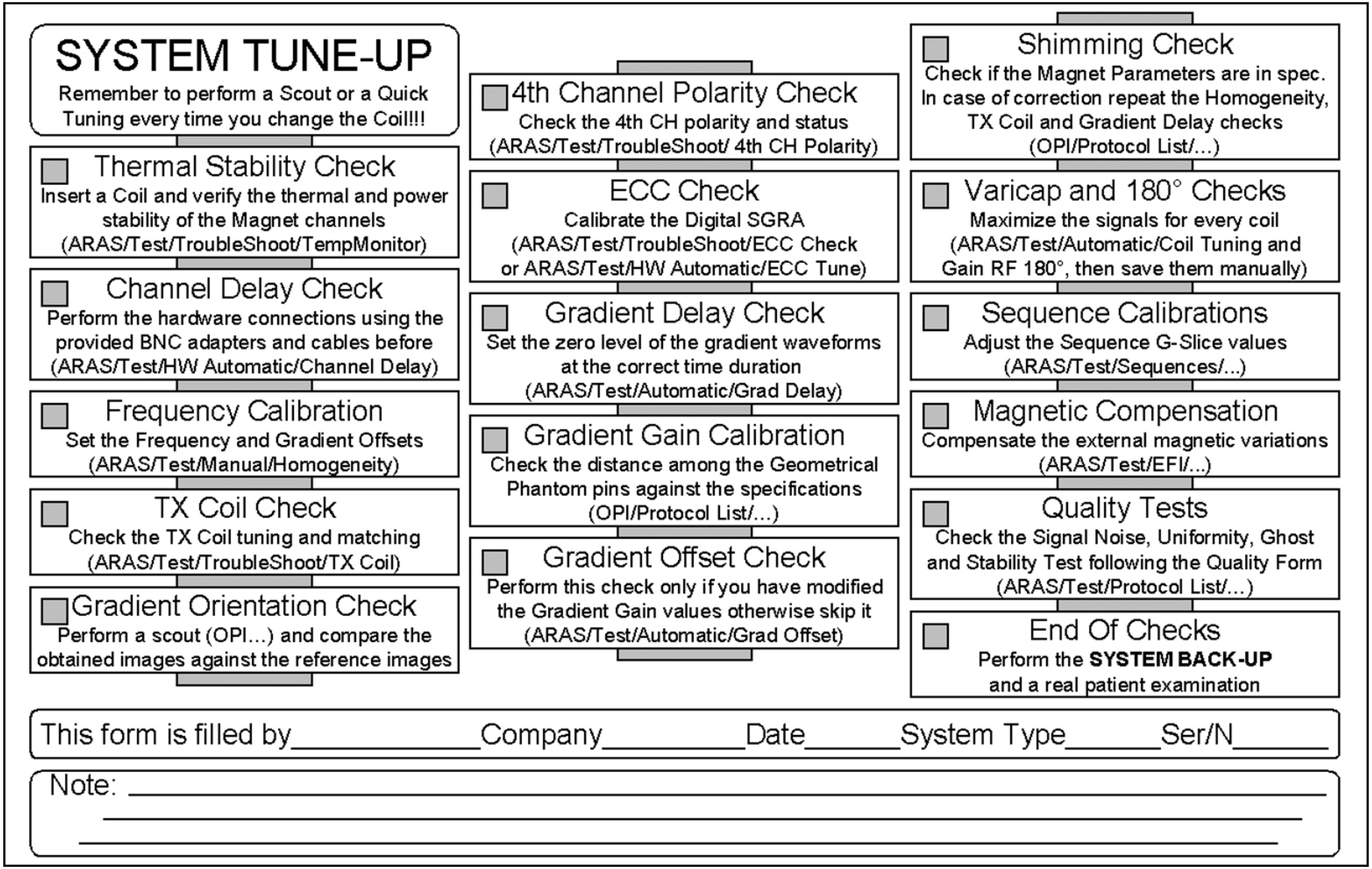


Fig. 235: ***PLEASE COMPLETE THE CALIBRATION FLOWCHART MARKING OFF ALL THE PERFORMED ITEMS AND E-MAIL/FAX BACK TO ESAOTE.***



SYSTEM TUNE-UP
Remember to perform a Scout or a Quick Tuning every time you change the Coil!!!

☐ Thermal Stability Check
Insert a Coil and verify the thermal and power stability of the Magnet channels
(ARAS/Test/TroubleShoot/TempMonitor)

☐ Channel Delay Check
Perform the hardware connections using the provided BNC adapters and cables before
(ARAS/Test/HW Automatic/Channel Delay)

☐ Frequency Calibration
Set the Frequency and Gradient Offsets
(ARAS/Test/Manual/Homogeneity)

☐ TX Coil Check
Check the TX Coil tuning and matching
(ARAS/Test/TroubleShoot/TX Coil)

☐ Gradient Orientation Check
Perform a scout (OPI...) and compare the obtained images against the reference images

☐ 4th Channel Polarity Check
Check the 4th CH polarity and status
(ARAS/Test/TroubleShoot/ 4th CH Polarity)

☐ ECC Check
Calibrate the Digital SGRA
(ARAS/Test/TroubleShoot/ECC Check or ARAS/Test/HW Automatic/ECC Tune)

☐ Gradient Delay Check
Set the zero level of the gradient waveforms at the correct time duration
(ARAS/Test/Automatic/Grad Delay)

☐ Gradient Gain Calibration
Check the distance among the Geometrical Phantom pins against the specifications
(OPI/Protocol List/...)

☐ Gradient Offset Check
Perform this check only if you have modified the Gradient Gain values otherwise skip it
(ARAS/Test/Automatic/Grad Offset)

☐ Shimming Check
Check if the Magnet Parameters are in spec. In case of correction repeat the Homogeneity, TX Coil and Gradient Delay checks
(OPI/Protocol List/...)

☐ Varicap and 180° Checks
Maximize the signals for every coil
(ARAS/Test/Automatic/Coil Tuning and Gain RF 180°, then save them manually)

☐ Sequence Calibrations
Adjust the Sequence G-Slice values
(ARAS/Test/Sequences/...)

☐ Magnetic Compensation
Compensate the external magnetic variations
(ARAS/Test/EFI/...)

☐ Quality Tests
Check the Signal Noise, Uniformity, Ghost and Stability Test following the Quality Form
(ARAS/Test/Protocol List/...)

☐ End Of Checks
Perform the **SYSTEM BACK-UP** and a real patient examination

This form is filled by______________ Company___________ Date_______ System Type_______ Ser/N_______

Note: ____

Fig. 236: System logical connection scheme

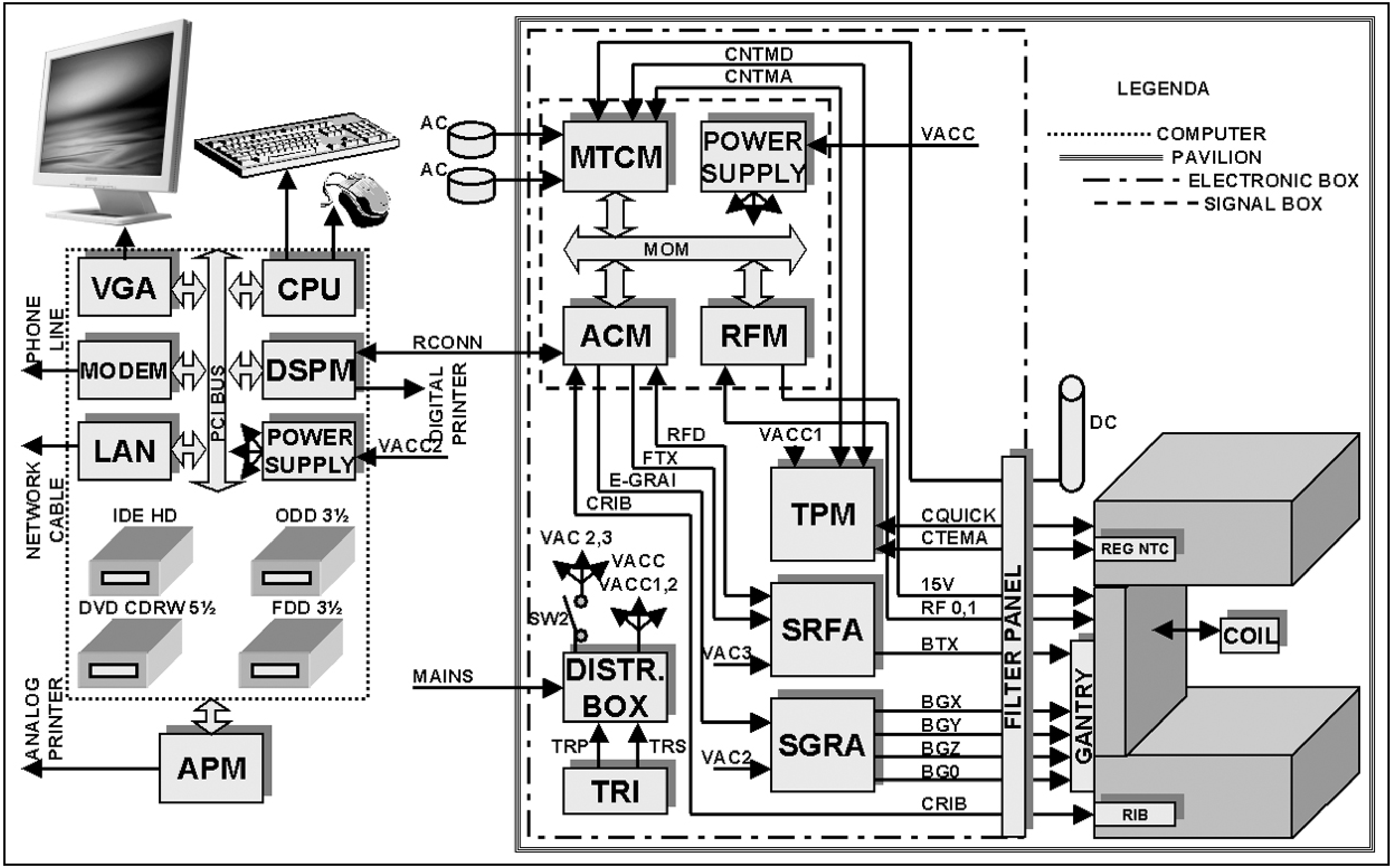
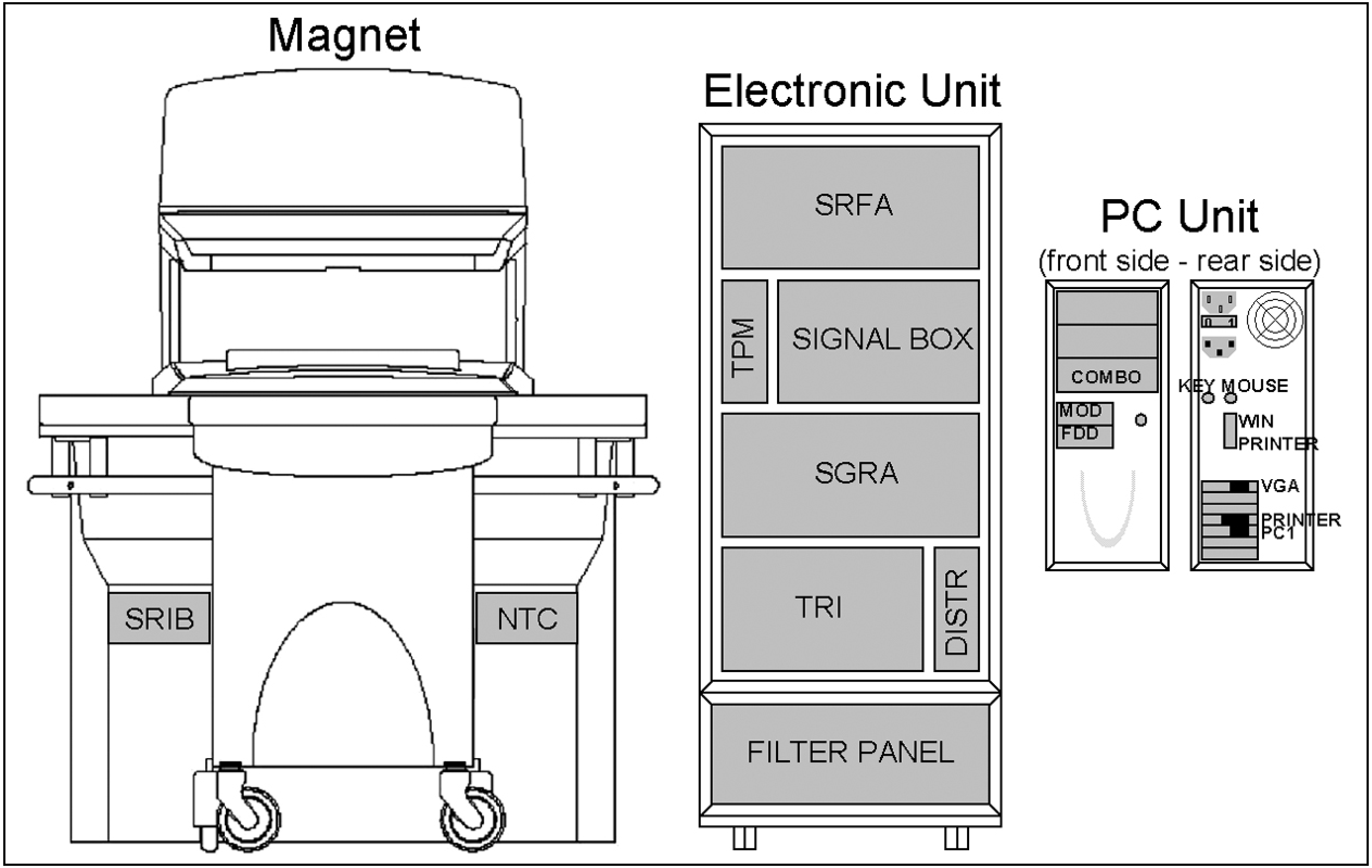


Fig. 237: System Module Positions



Thermostatic Stability Control

Thermostatic control is very important because ferrite has a thermal coefficient that causes resonant frequency to change by approximately. 15 kHz with temperature differences of one degree centigrade. While executing each scan, it is therefore necessary to limit temperature fluctuations to around one thousandth of a degree.

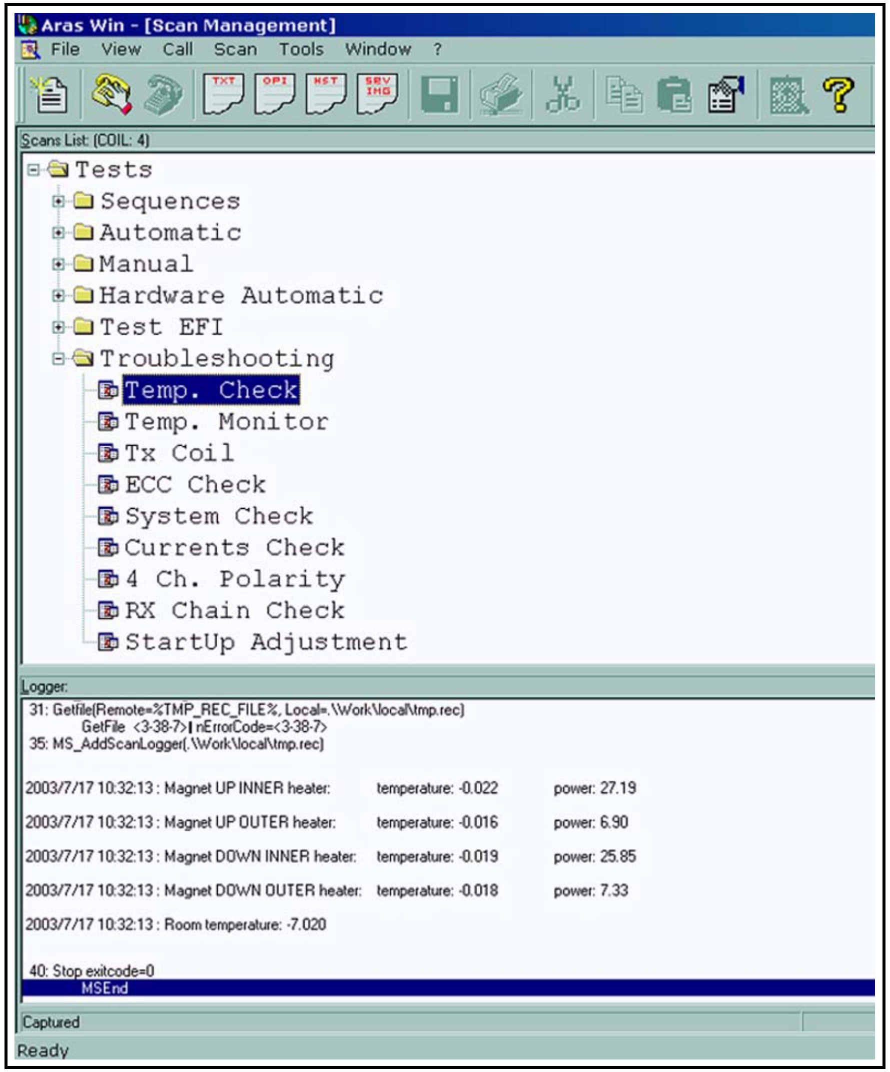
The program detects some data concerning the thermal condition of the magnet: deviations (dT) with respect to the required temperature value and the powers of each magnet block's heaters (up inner, up outer, down inner and down outer). In addition, the program can detect the environment temperature by a sensor put outside the magnet and connected to the MTCM module. The program sends this information to the **“Temp.rec”** file. Normally, dT's will be in the region of some hundredths of a degree.

In any case, it is not the absolute value of the dT's that is important, but rather their stability over time. The maximum powers are 50 Watts for the inner channels and 20-Watts for the outer channels. Please note that thermostatic control is guaranteed by keeping the magnet at the correct temperature (ideal 36°). The shown values are the difference between the ideal and the real temperature. It is clear that any malfunctions in the MTCM (or TPM) module, the sensors or in the heaters will cause abnormalities in the measured data. The program warns of a possible anomaly if one dT is greater than 0.1 °C.

Automatic Test

- Select under ARAS **<Test> <Troubleshoot.> <Temp. Check>**, then **<Exec>** and Look at the message displayed by the calibration procedure and at the logger window for the temperature error and power values
- If not successful, check the rec file for any problems
  - Under Internet Explorer select **<Rec Management> <System Temperatures> <View Rec Folders>** and the **<Today Folder>**, then look for the **“Temp.rec”** file and open it
  - Using the scroll bar, go to the end of the file and look at the calibration data

Fig. 238: Automatic Temp Check



```
 31: Getfile(Remote=%TMP_REC_FILE%, Local=.\Work\local\tmp.rec)
        GetFile  <3-38-7>| nErrorCode=<3-38-7>
 35: MS_AddScanLogger(.\Work\local\tmp.rec)

2003/7/17 10:32:13 : Magnet UP INNER heater:      temperature: -0.022      power: 27.19

2003/7/17 10:32:13 : Magnet UP OUTER heater:      temperature: -0.016      power: 6.90

2003/7/17 10:32:13 : Magnet DOWN INNER heater:    temperature: -0.019      power: 25.85

2003/7/17 10:32:13 : Magnet DOWN OUTER heater:    temperature: -0.018      power: 7.33

2003/7/17 10:32:13 : Room temperature: -7.020


 40: Stop exitcode=0
        MSEnd
```

Stability Check

- Select, under ARAS, **<Test> <Troubleshoot.> <Temp. Monitor> <Exec>**
- The System Diascope displays the power and the temperature of every magnet channel, as shown in figure
- Select one magnet channel clicking on Channel arrow buttons
- Select **<A>** and **<Y>** from the menu bar
- Center the temperature line changing the **<Displacement>** and zoom it using **<Dec. Div.>**
- Select **<B>** from the menu bar
- Center the power line changing the **<Displacement>** and zoom it using **<Dec. Div.>**
- Select **<Dual>** function in the Diascope bar to display power and temperature
- Let the System test run until the temperature and power lines are almost at the end of the visualization display then click on **<Pause>** function in the Diascope bar
- Using the cursor, measure the maximum and minimum values of the temperature line

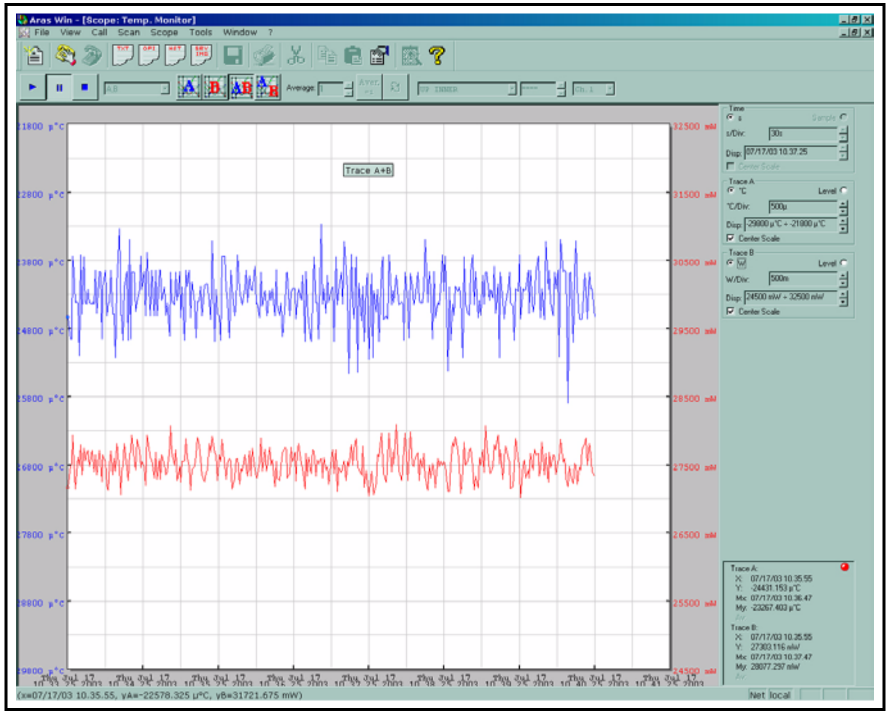
  Temp Mean = (Temp MAX + Temp MIN) / 2

  Temp Deviation = Temp MAX - Temp MIN
- Fill in the **Installation Quality Form** with the calculated values
- Using the cursor, measure the maximum and minimum values of the power line

  Power Mean = (Power MAX + Power MIN) / 2

  Power Deviation = Power MAX - Power MIN
- Fill in the **Installation Quality Form** with the calculated values

Fig. 239: System Monitor temperature and power



s/Div: 30s

Disp: 07/17/03 10.37.25

☐ Center Scale

°C/Div: 500µ

Disp: -29800 µ°C ÷ -21800 µ°C

☑ Center Scale

W/Div: 500m

Disp: 24500 mW ÷ 32500 mW

☑ Center Scale

Trace A:
X: 07/17/03 10.35.55
Y: -24431.153 µ°C
Mx: 07/17/03 10.36.47
My: -23267.403 µ°C

Trace B:
X: 07/17/03 10.35.55
Y: 27303.116 mW
Mx: 07/17/03 10.37.47
My: 28077.297 mW

(x=07/17/03 10.35.55, yA=-22578.325 µ°C, yB=31721.675 mW)

- Select the next channel and repeat the centering and measuring procedure for every magnet channel
- At the end click on **<Quit>** to escape from the test

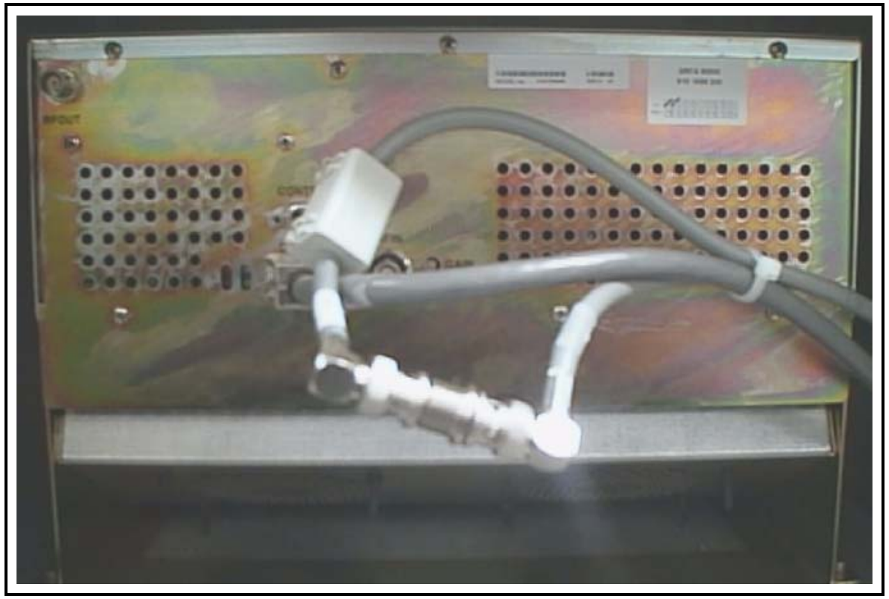
If the calculated Mean and Deviation values are not correct check:

- Temperature rec file (temp.rec)
- MTCM and TPM cable connections
- Filter panel cables connection
- Magnet cables connection (panel and NTC board)
- Repeat the Thermal Stability test after one hour

Channel Delay Adjustment

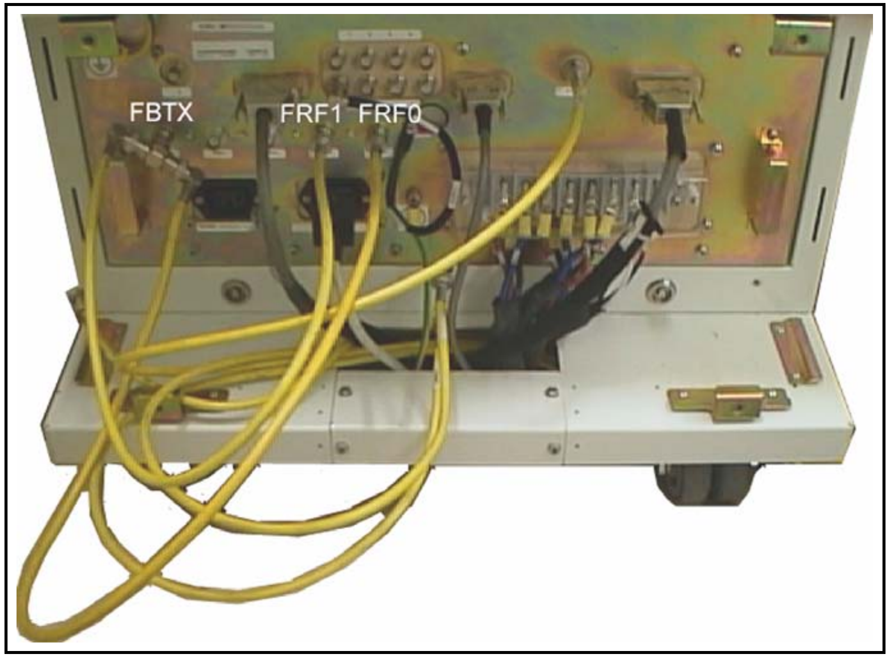
- Perform the following hardware connection:
  - – Open the Electronic Unit
  - – Using an “I” BNC connector (also called “bullet”) join the RFAIN cable connector to the RFAOUT cable connector disconnecting them from the RFA module (as shown in the next figure)

Fig. 240: SRFA Connection



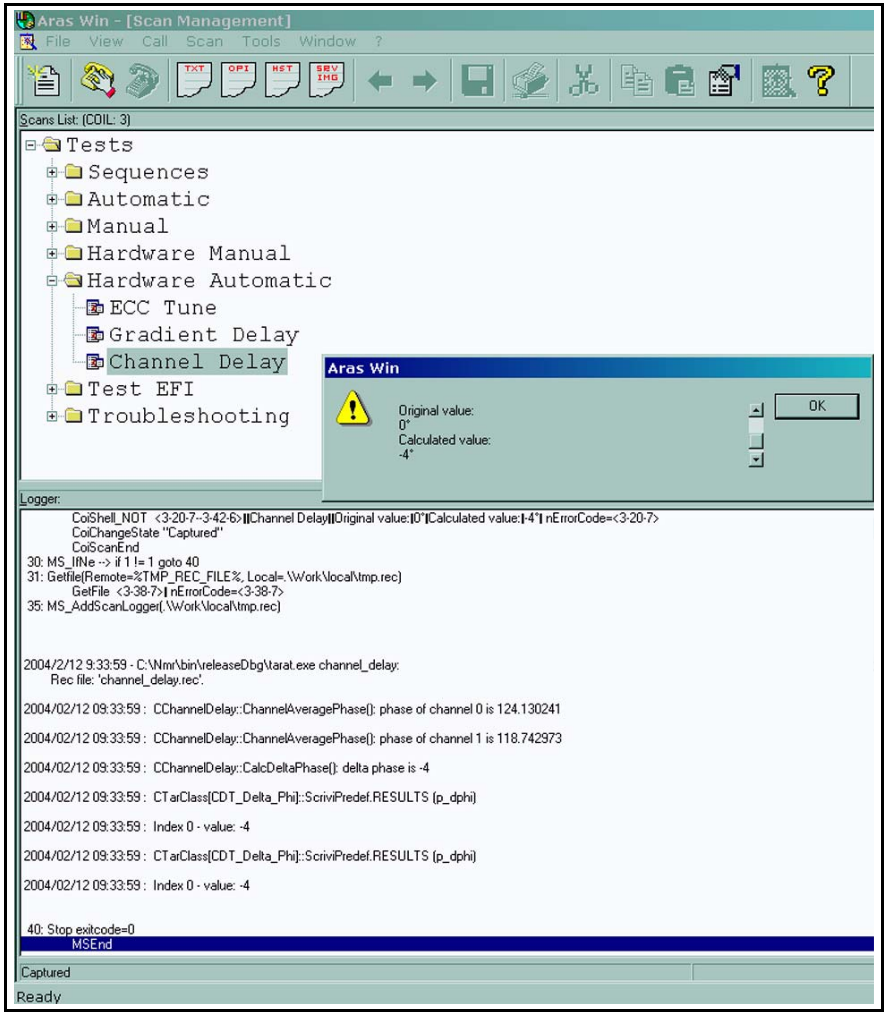
  - – Open the Filter Panel cover
  - – Using the “T” BNC connector join the FBTX connector of the Filter Panel to the FRF0 and FRF1 connectors of the filter panel disconnecting the cables connected to them and using the provided cables (as shown in the next figure)

Fig. 241: Filter Panel Connection



- Under ARAS select **<Test> <HW Automatic> <Channel Delay> <Exec>**
- The system will automatically calibrate and save the receiving channel offset, the found values are visible in the logger window

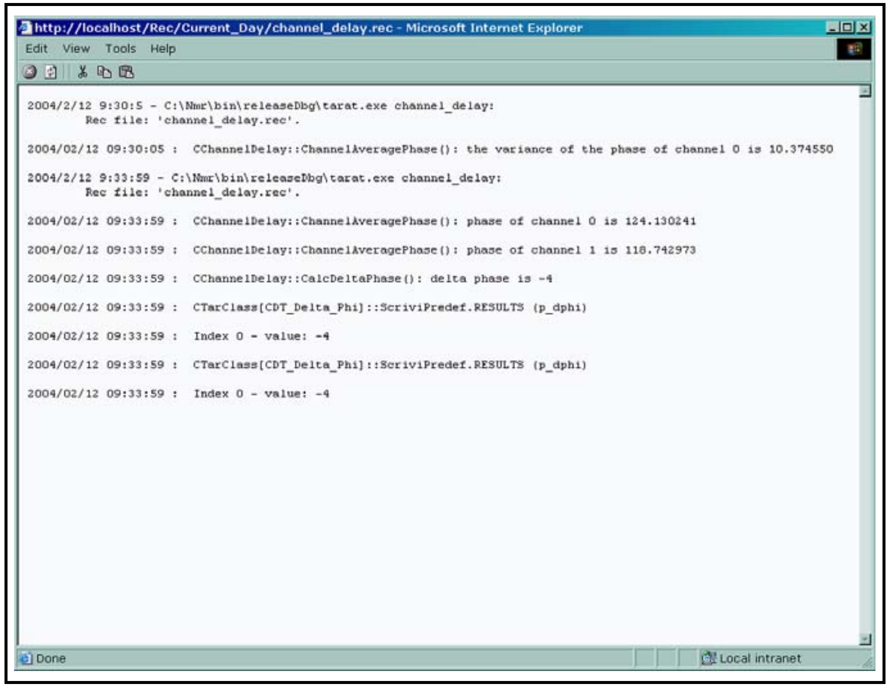
Fig. 242: Channel Delay Calibration



Original value:
0°
Calculated value:
-4°

```
        CoiShell_NOT  <3-20-7--3-42-6>||Channel Delay||Original value:|0°|Calculated value:|-4°| nErrorCode=<3-20-7>
        CoiChangeState "Captured"
        CoiScanEnd
 30: MS_IfNe --> if 1 != 1 goto 40
 31: Getfile(Remote=%TMP_REC_FILE%, Local=.\Work\local\tmp.rec)
        GetFile  <3-38-7>| nErrorCode=<3-38-7>
 35: MS_AddScanLogger(.\Work\local\tmp.rec)


2004/2/12 9:33:59 - C:\Nmr\bin\releaseDbg\tarat.exe channel_delay:
      Rec file: 'channel_delay.rec'.

2004/02/12 09:33:59 :  CChannelDelay::ChannelAveragePhase(): phase of channel 0 is 124.130241

2004/02/12 09:33:59 :  CChannelDelay::ChannelAveragePhase(): phase of channel 1 is 118.742973

2004/02/12 09:33:59 :  CChannelDelay::CalcDeltaPhase(): delta phase is -4

2004/02/12 09:33:59 :  CTarClass[CDT_Delta_Phi]::ScriviPredef.RESULTS (p_dphi)

2004/02/12 09:33:59 :  Index 0 - value: -4

2004/02/12 09:33:59 :  CTarClass[CDT_Delta_Phi]::ScriviPredef.RESULTS (p_dphi)

2004/02/12 09:33:59 :  Index 0 - value: -4


 40: Stop exitcode=0
        MSEnd
```

Fig. 243: Channel_delay.rec


http://localhost/Rec/Current_Day/channel_delay.rec - Microsoft Internet Explorer
Edit View Tools Help
Done
Local intranet

```
2004/2/12 9:30:5 - C:\Nmr\bin\releaseDbg\tarat.exe channel_delay:
        Rec file: 'channel_delay.rec'.

2004/02/12 09:30:05 :  CChannelDelay::ChannelAveragePhase(): the variance of the phase of channel 0 is 10.374550

2004/2/12 9:33:59 - C:\Nmr\bin\releaseDbg\tarat.exe channel_delay:
        Rec file: 'channel_delay.rec'.

2004/02/12 09:33:59 :  CChannelDelay::ChannelAveragePhase(): phase of channel 0 is 124.130241

2004/02/12 09:33:59 :  CChannelDelay::ChannelAveragePhase(): phase of channel 1 is 118.742973

2004/02/12 09:33:59 :  CChannelDelay::CalcDeltaPhase(): delta phase is -4

2004/02/12 09:33:59 :  CTarClass[CDT_Delta_Phi]::ScriviPredef.RESULTS (p_dphi)

2004/02/12 09:33:59 :  Index 0 - value: -4

2004/02/12 09:33:59 :  CTarClass[CDT_Delta_Phi]::ScriviPredef.RESULTS (p_dphi)

2004/02/12 09:33:59 :  Index 0 - value: -4
```

- If the values are correct, fill in the Installation Quality Form with the calculated values
- The corresponding rec file is called **channel_delay.rec**

Frequency Calibration

Manual Homogeneity Calibration

NOTICE	During system installation or troubleshooting we suggest to perform the frequency and gradient offset calibration manually, after that and during system maintenance it's possible to choose the automatic method explained in this chapter

Introduction

This calibration is used to adjust the gradients' offsets, that is to say those field gradient residues that are always on and contribute to the shimming of the static magnetic field. This calibration is very delicate. The module has a characteristic bell shape. The final result we aim for is a signal intercepting the window's sides at the highest possible points (obviously, adjusting the receiving gain so that the central peak is close to the maximum).

When entering the manual plot, the gains must be set so that echo peak, in **<Module>** mode, will be as close to the maximum as possible. During calibration, further adjustments may become necessary.

Moreover, when observing the phase of the signal, you must check that resonance is in place and, if necessary, through small changes in frequency, the phase must be set as horizontal as possible. If the gradients and the shimming in general are not perfect, this phase has a sinusoidal shape that needs to be “flattened” as much as possible by adjusting the gradient offsets.

Find the best gradient offset values in order to obtain as large a homogeneity curve as possible (as shown in the following figures). Small variations of these values are not a cause for concern. The most important thing is that the values do not exceed 2000, unless set during final inspection.

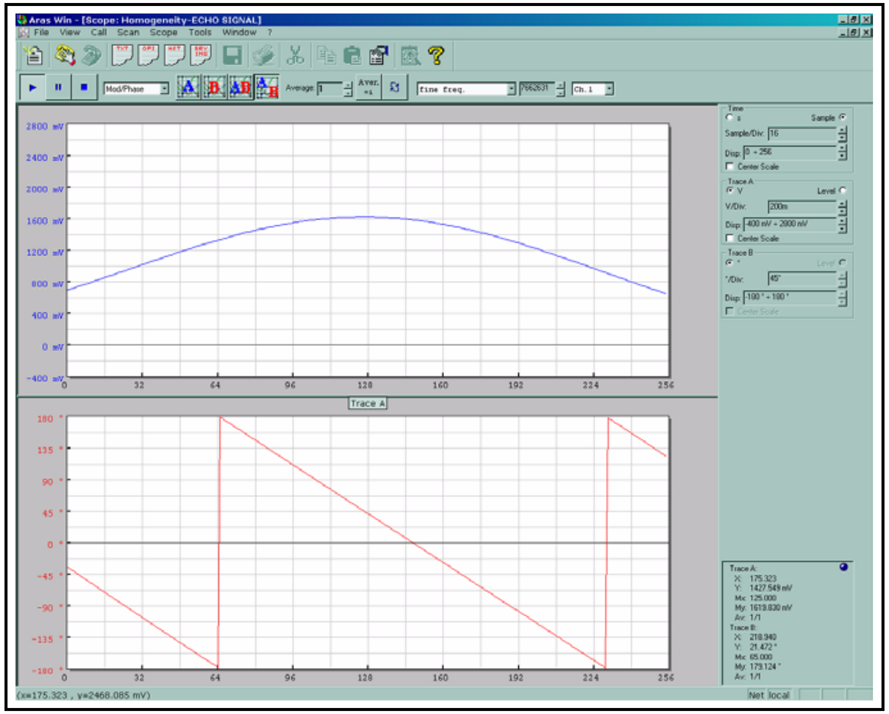
Necessary Tools

– Geometrical Phantom and its support

Check Operations

- Position the Knee Coil 2 with the geometrical phantom placed in Axial position
- Under ARAS select **<Manual> <Homogeneity>** then **<Exec>**
- Adjust the **<Gain 1>** to bring the signal to about 20 k (usually gain 1 = 60)
- Adjust the **FREQUENCY** variable using the **<FINE FREQ.>** step and find a value of this variable corresponding to a generally horizontal phase (lower signal-red trace). If the displayed frequency is very far from the correct one (almost flat blue trace and red one with many intersections with the middle zero line) could be necessary to use the **<COURSE FREQ.>** step first to set a closer frequency to the correct one and then use the **<FINE FREQ.>**
- Adjust the **<OFFSET X>** variable to obtain the maximum “wide” of the echo signal (upper signal-blue trace)
- Adjust the **<OFFSET Y>** variable to obtain the maximum “wide” of the echo signal (upper signal-blue trace)
- Adjust the **<OFFSET Z>** variable to obtain the maximum “wide” of the echo signal (upper signal-blue trace)

Fig. 244: Homogeneity test not perfectly calibrated



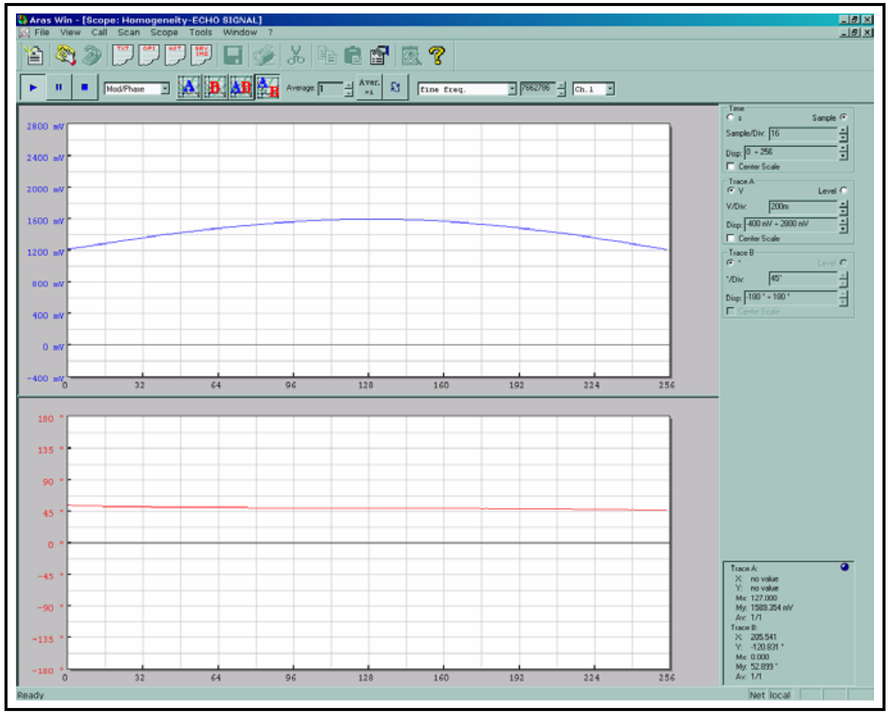
Aras Win - [Scope: Homogeneity-ECHO SIGNAL]

Trace A:
X: 175.323
Y: 1427.549 mV
Mx: 125.000
My: 1619.830 mV
Av: 1/1
Trace B:
X: 218.340
Y: 21.472 °
Mx: 65.000
My: 179.124 °
Av: 1/1

(x=175.323 , y=2468.085 mV)

NOTICE During the <OFFSET> adjustment check the phase signal stability. Sometimes changes to the offset do not improve the echo signal but disturb the phase signal. If you over compensate any of the gradients the Phase line (red trace) won't be perfectly flat but distorted at the ends.

Fig. 245: Homogeneity test perfectly calibrated



Aras Win - [Scope: Homogeneity-ECHO SIGNAL]

Trace A:
X: no value
Y: no value
Mx: 127.000
My: 1589.354 mV
Av: 1/1
Trace B:
X: 205.541
Y: -120.831 °
Mx: 0.000
My: 52.899 °
Av: 1/1

Ready

- Quit and save all the variables
- Fill in the **Installation Quality Form** with the saved values

Automatic Calibration

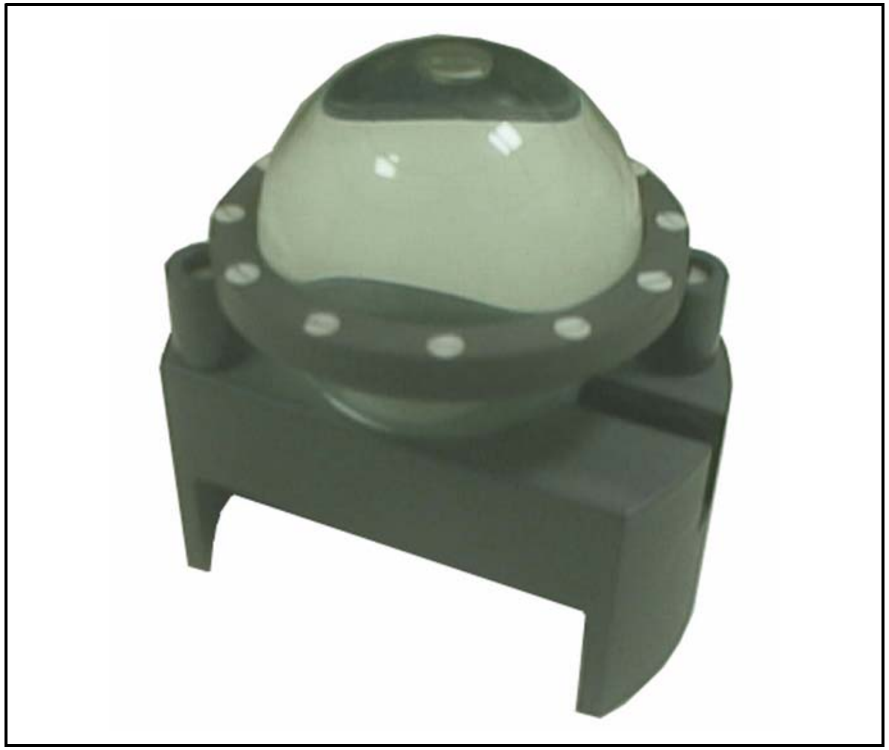
Necessary Tools

- Spherical Phantom 86 mm and its support

Operation

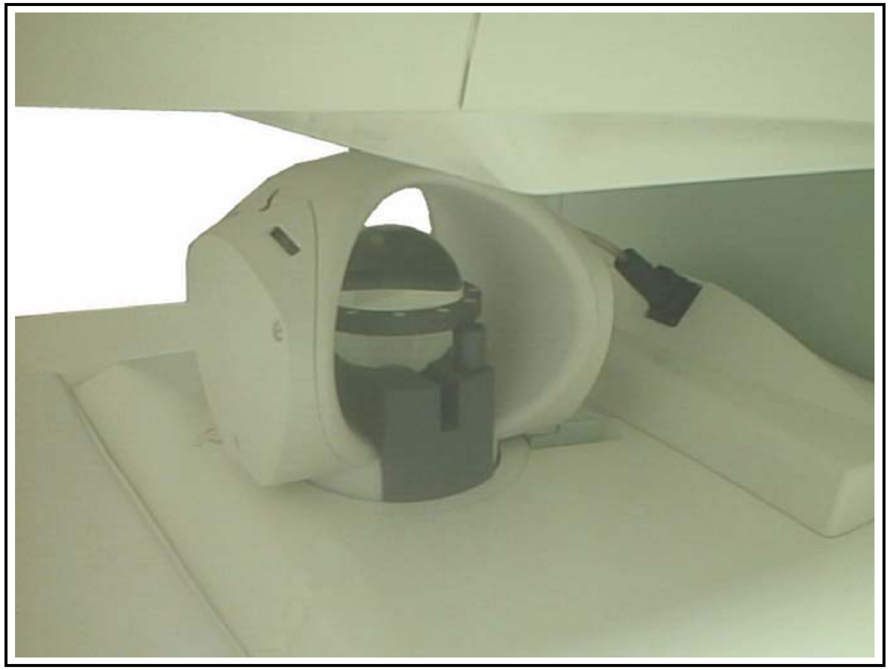
- Place the spherical phantom 86 mm on its holder (like shown in the next figure)

Fig. 246: Spherical Phantom 86 mm and its holder



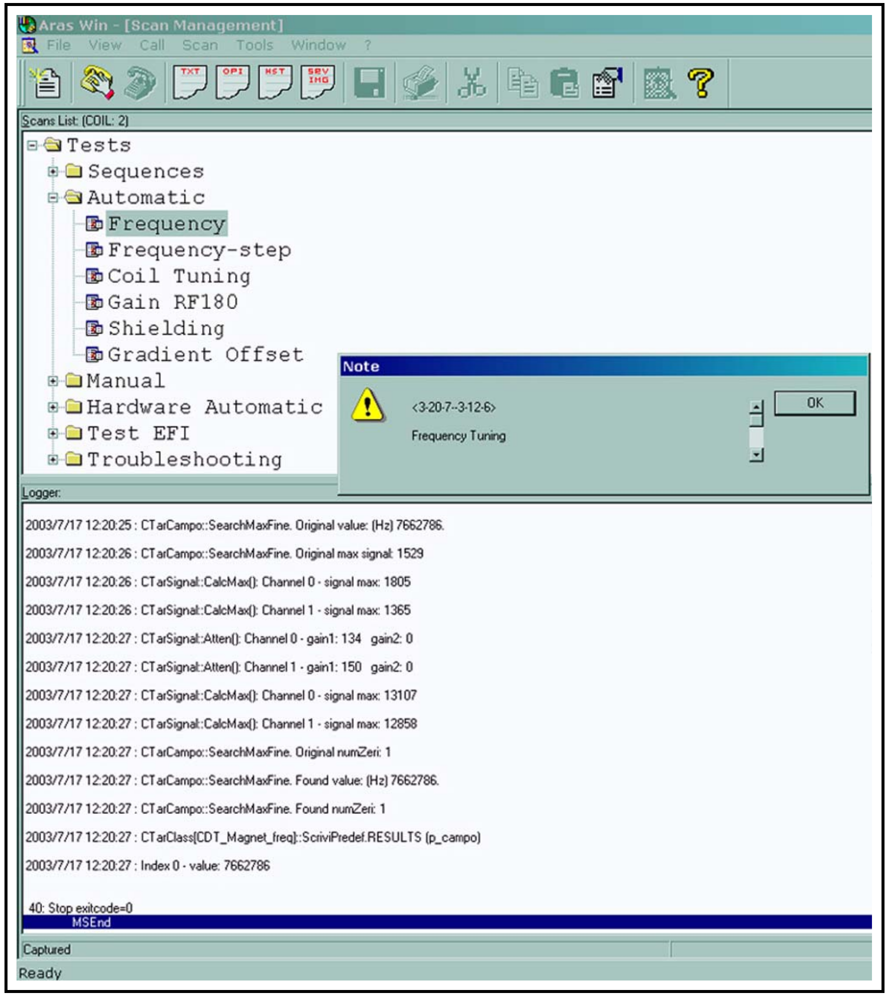
- Insert Phantom and holder into the Coil 2 and into the Magnet (like shown in the next figure)

Fig. 247: Correct Phantom position



- Acquire a scout selecting the district **“Other”** and bed position **A**
- Under ARAS select **<Test> <Automatic> <Frequency> <Exec>** and calibrate the system frequency (the found frequency is automatically saved), if the system is not able to calibrate the frequency check the RX chain (refer to the Service Manual, RF chapter)

Fig. 248: Auto Frequency calibration result

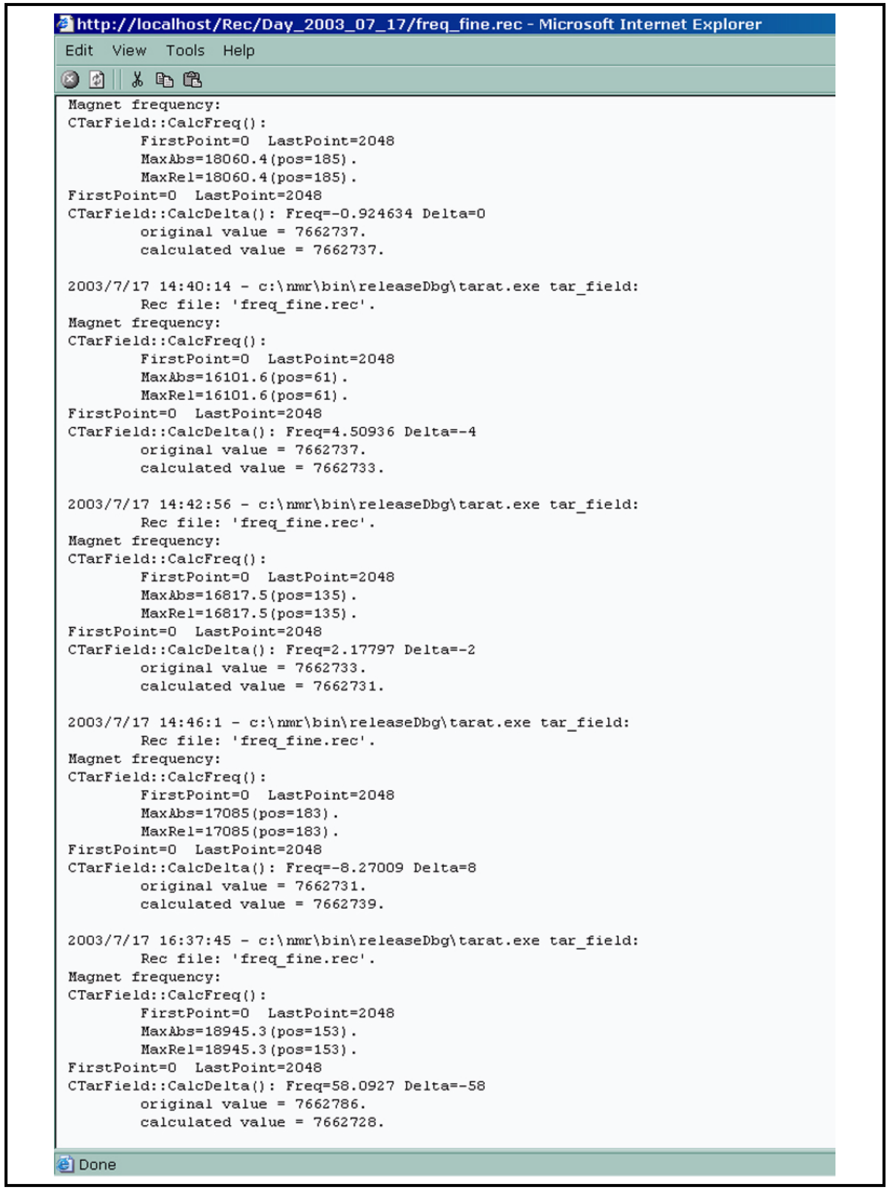


```
<3-20-7--3-12-6>
Frequency Tuning
```

```
2003/7/17 12:20:25 : CTarCampo::SearchMaxFine. Original value: (Hz) 7662786.
2003/7/17 12:20:26 : CTarCampo::SearchMaxFine. Original max signal: 1529
2003/7/17 12:20:26 : CTarSignal::CalcMax(): Channel 0 - signal max: 1805
2003/7/17 12:20:26 : CTarSignal::CalcMax(): Channel 1 - signal max: 1365
2003/7/17 12:20:27 : CTarSignal::Atten(): Channel 0 - gain1: 134   gain2: 0
2003/7/17 12:20:27 : CTarSignal::Atten(): Channel 1 - gain1: 150   gain2: 0
2003/7/17 12:20:27 : CTarSignal::CalcMax(): Channel 0 - signal max: 13107
2003/7/17 12:20:27 : CTarSignal::CalcMax(): Channel 1 - signal max: 12858
2003/7/17 12:20:27 : CTarCampo::SearchMaxFine. Original numZeri: 1
2003/7/17 12:20:27 : CTarCampo::SearchMaxFine. Found value: (Hz) 7662786.
2003/7/17 12:20:27 : CTarCampo::SearchMaxFine. Found numZeri: 1
2003/7/17 12:20:27 : CTarClass[CDT_Magnet_freq]::ScriviPredef.RESULTS (p_campo)
2003/7/17 12:20:27 : Index 0 - value: 7662786

 40: Stop exitcode=0
        MSEnd
```

- Fill in the **Installation Quality Form** with the calculated value
- The corresponding rec file is called **freq.rec** and **freq_fine.rec** (like shown in the next figure)

Fig. 249: freq_fine rec file


http://localhost/Rec/Day_2003_07_17/freq_fine.rec - Microsoft Internet Explorer
Edit View Tools Help
Done

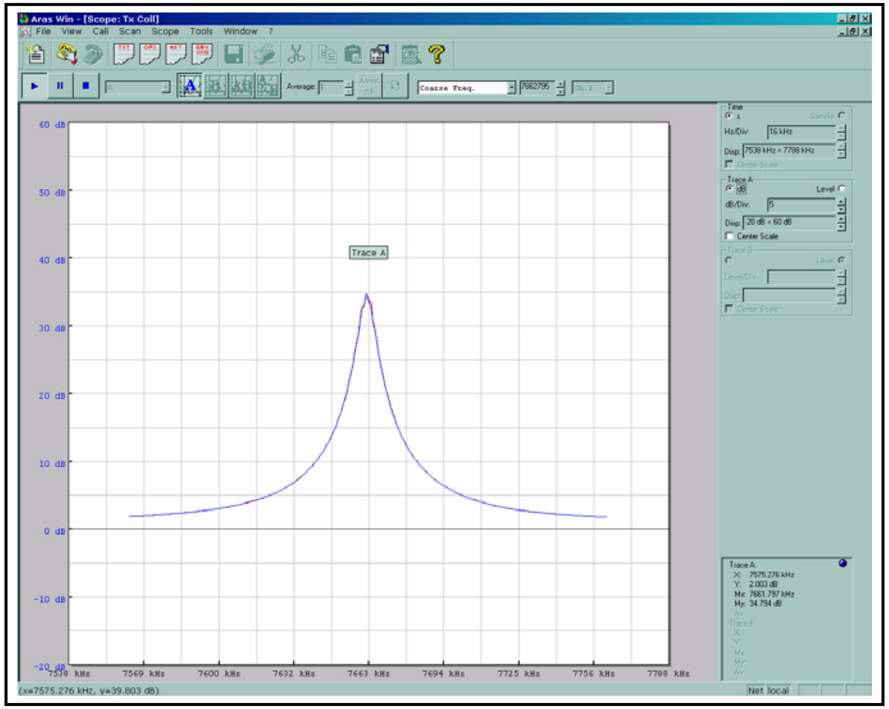
```
Magnet frequency:
CTarField::CalcFreq():
        FirstPoint=0  LastPoint=2048
        MaxAbs=18060.4(pos=185).
        MaxRel=18060.4(pos=185).
FirstPoint=0  LastPoint=2048
CTarField::CalcDelta(): Freq=-0.924634 Delta=0
        original value = 7662737.
        calculated value = 7662737.

2003/7/17 14:40:14 - c:\nmr\bin\releaseDbg\tarat.exe tar_field:
        Rec file: 'freq_fine.rec'.
Magnet frequency:
CTarField::CalcFreq():
        FirstPoint=0  LastPoint=2048
        MaxAbs=16101.6(pos=61).
        MaxRel=16101.6(pos=61).
FirstPoint=0  LastPoint=2048
CTarField::CalcDelta(): Freq=4.50936 Delta=-4
        original value = 7662737.
        calculated value = 7662733.

2003/7/17 14:42:56 - c:\nmr\bin\releaseDbg\tarat.exe tar_field:
        Rec file: 'freq_fine.rec'.
Magnet frequency:
CTarField::CalcFreq():
        FirstPoint=0  LastPoint=2048
        MaxAbs=16817.5(pos=135).
        MaxRel=16817.5(pos=135).
FirstPoint=0  LastPoint=2048
CTarField::CalcDelta(): Freq=2.17797 Delta=-2
        original value = 7662733.
        calculated value = 7662731.

2003/7/17 14:46:1 - c:\nmr\bin\releaseDbg\tarat.exe tar_field:
        Rec file: 'freq_fine.rec'.
Magnet frequency:
CTarField::CalcFreq():
        FirstPoint=0  LastPoint=2048
        MaxAbs=17085(pos=183).
        MaxRel=17085(pos=183).
FirstPoint=0  LastPoint=2048
CTarField::CalcDelta(): Freq=-8.27009 Delta=8
        original value = 7662731.
        calculated value = 7662739.

2003/7/17 16:37:45 - c:\nmr\bin\releaseDbg\tarat.exe tar_field:
        Rec file: 'freq_fine.rec'.
Magnet frequency:
CTarField::CalcFreq():
        FirstPoint=0  LastPoint=2048
        MaxAbs=18945.3(pos=153).
        MaxRel=18945.3(pos=153).
FirstPoint=0  LastPoint=2048
CTarField::CalcDelta(): Freq=58.0927 Delta=-58
        original value = 7662786.
        calculated value = 7662728.
```

Transmission Coil Check

The purpose of transmission coil calibration is to check the impedance matching to 50 Ω ± 5 Ω and the tuning to the central frequency of the magnet. The “Diascope” allows displaying the “return loss” between the transmitted and the reflected power in dB. This waveform has a peak that must be moved to the center of the X-axis, which means that the coil is tuned to the correct frequency. Besides, it is very important to check that impedance is 50 Ω.

- Insert the Coil 2 (Knee) with the homogeneous phantom into the magnet in axial position then, under ARAS, select **<Test> <Troubleshoot.> <TX Coil> <EXEC>**

Fig. 250: TX coil test



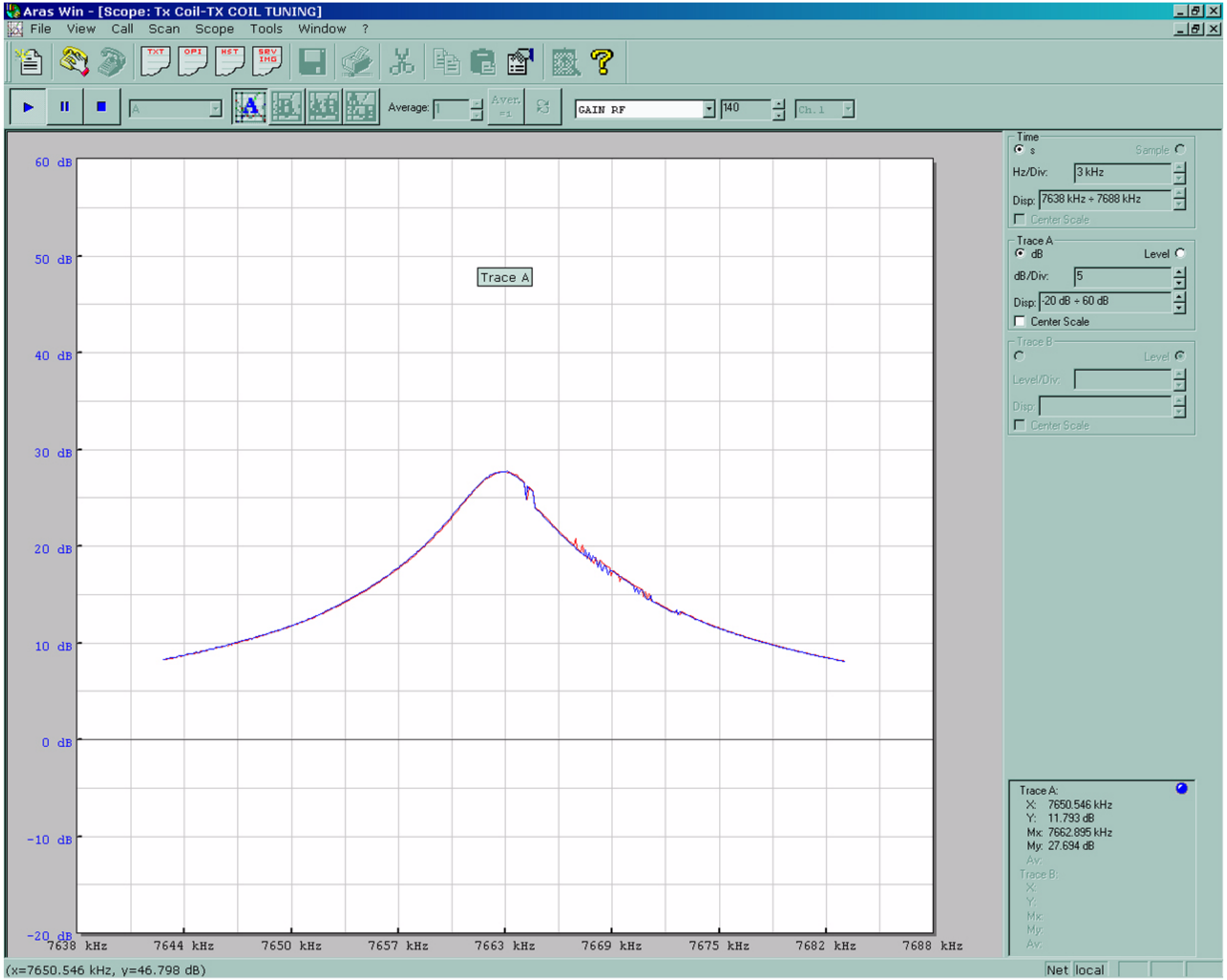
Average: 1
Coarse Freq. 7662795
Time
● s ○ Sample
Hz/Div: 16 kHz
Disp: 7538 kHz ÷ 7788 kHz
☐ Center Scale
Trace A
● dB ○ Level
dB/Div: 5
Disp: -20 dB ÷ 60 dB
☐ Center Scale
Trace B
○ ● Level
Level/Div:
Disp:
☐ Center Scale
Trace A:
X: 7575.276 kHz
Y: 2.003 dB
Mx: 7661.797 kHz
My: 34.794 dB
Av:
Trace B:
X:
Y:
Mx:
My:
Av:
(x=7575.276 kHz, y=39.803 dB)

- Set the visualization unit to 5dB
- Changing the channel, select the **SPAN STEP** field and set it at **100 Hz**
- Select the channel number 4 clicking on the up arrow and set the **GAIN RF** at 140. The **GAIN RF** can be digitally set from 0 (0 Watt) to 255 (900 Watt)

NOTICE	If the TX peak is not tuned to the magnet frequency or closer when the gain RF is set at 140 the RFA could go into protection mode. In this case move the peak using the variable capacitors and then perform the check!!!

- Check if the pulse is in the central position of the screen because magnet frequency is shown at the screen center. The maximum acceptable range is ±2.5 KHz from the central frequency. Otherwise you must adjust the tuning circuit
- Check if the peak highest point is at least 20 dB, otherwise adjust the matching circuit. The System shows all the information about the displayed pulse on the right bottom corner of the screen
- Fill in the **Installation Quality Form** with the calculated values if they are in spec otherwise proceed with the adjustment procedure

Fig. 251: TX Coil check (GAIN RF set to 140)



GAIN RF 140

Time
● s ○ Sample
Hz/Div: 3 kHz
Disp: 7638 kHz ÷ 7688 kHz
☐ Center Scale

Trace A
● dB ○ Level
dB/Div: 5
Disp: -20 dB ÷ 60 dB
☐ Center Scale

Trace B
○ ● Level
Level/Div:
Disp:
☐ Center Scale

Trace A:
X: 7650.546 kHz
Y: 11.793 dB
Mx: 7662.895 kHz
My: 27.694 dB
Av:
Trace B:
X:
Y:
Mx:
My:
Av:

(x=7650.546 kHz, y=46.798 dB)

Adjustment Procedure

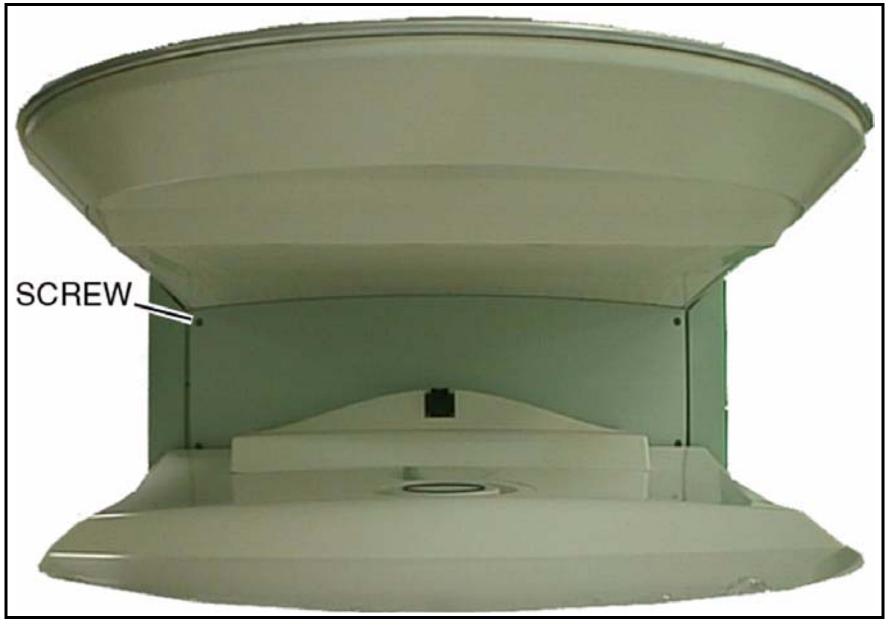
Necessary Tools

- Non ferromagnetic screwdriver
- Kit capacitors for Transmission Coil tuning
- Solder

Operations

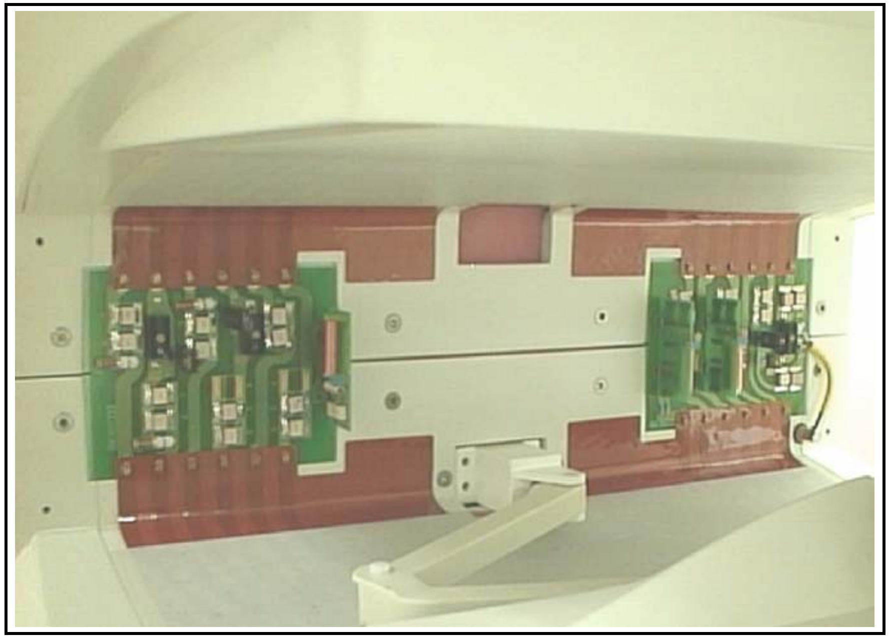
If the transmission peak is not correct, first of all remove the transmission circuits cover (removing the four screw in the cover corners) in order to have access to the transmission circuits. As shown in the next figure.

Fig. 252: *The transmitting circuits cover*



⚠**WARNING** **Don't touch the TX Coil circuit when the Gain RF is set to 140 to avoid electric shock (the sent power is very high): set it back to 40!**

Fig. 253: *Transmission circuits without cover*

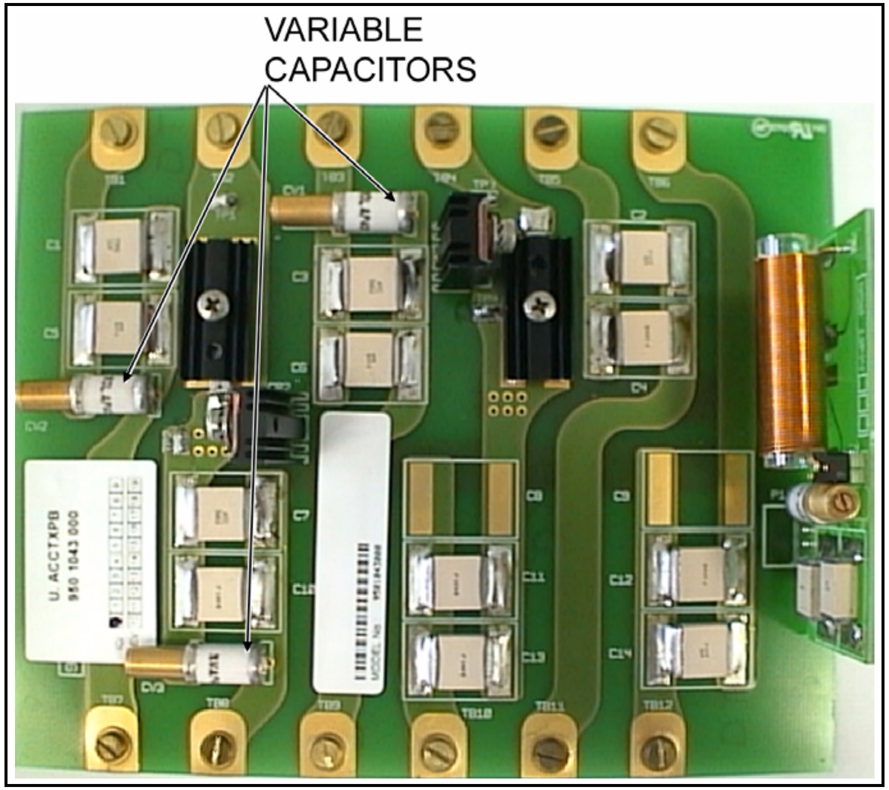


There are two circuits for the transmission coil: the left circuit is for tuning; the right circuit for matching. The diodes present on both the circuits are for de-coupling between the transmitting and receiving coils.

Tuning

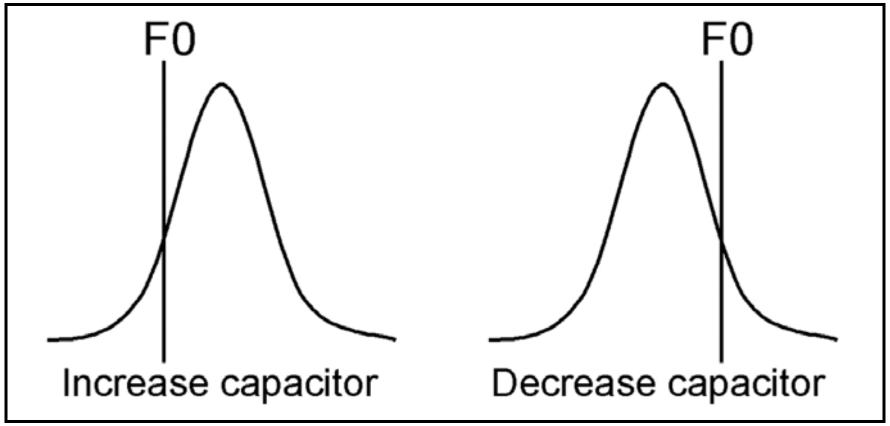
- Using the variable capacitors present on the tuning circuit you can move the pulse at maximum 50 KHz (f0 ± 25 KHz). The variable capacitor position is shown in the following figure.

Fig. 254: Tuning circuit



- Turn the three variable capacitors by the same value (Example: two turns for each capacitor) and see directly on the monitor if you are moving the pulse in the right direction.

Fig. 255: Example of transmission peaks



- If the variable capacitors are not sufficient to reach the correct frequency you can change the value of the fixed capacitance using the criteria shown in the previous figure
- Quit the TX coil test, place the Variable Capacitor values in the middle of their characteristics turning them ten turns each one and remove one circuit from the gantry in according to the following procedure:
  - If you have to move the peak to the left, remove the **Matching Circuit** and start to decrease one of these capacitors: C2, C7, C9, C10, C11 or C12
  - If you have to move the peak to the right, remove the **Tuning Circuit**, and start to increase one of these capacitors: C2, C4, C11, C12, C13 or C14. **Never use Capacitors bigger then 390 pF**

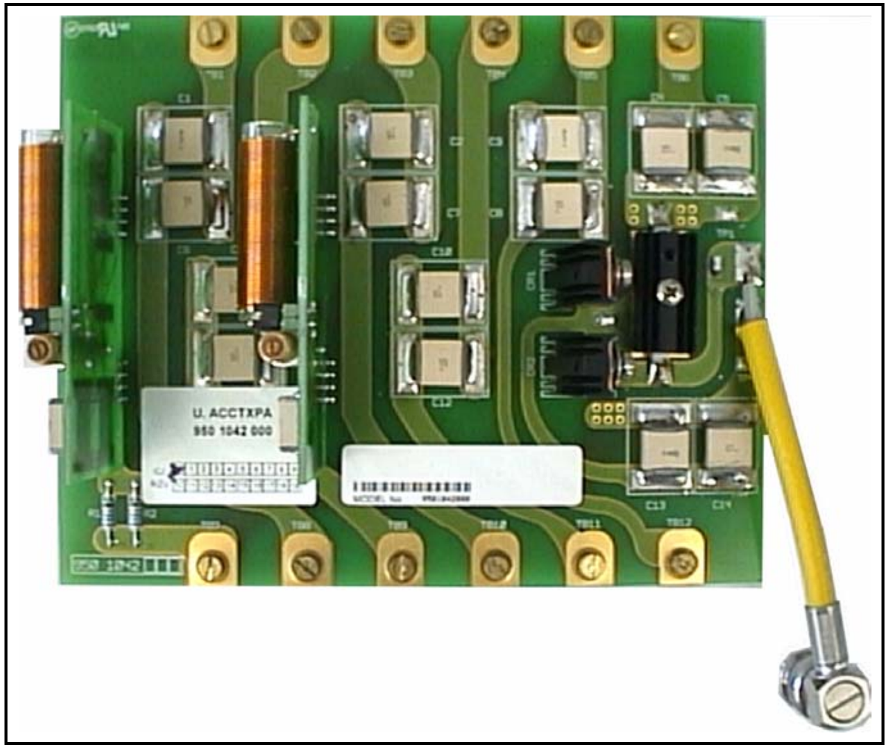
NOTICE	Verify that after reassembling the cover on the transmission circuits the TX peak is still in the correct position

Matching

If the pulse is lower than 20 dB you must increase the matching of the transmission coil.

In this case change the value of the fixed capacitors of the matching circuit shown in the following figure.

Fig. 256: Matching circuit



⚠**WARNING** **Don't touch the TX Coil circuit when the Gain RF is set to 140 to avoid electric shock (the sent power is very high): set it back to 40!**

Touch the TX-coil with your hand close to the matching circuit to find out if you have to increase or decrease the capacitance value to obtain the correct matching value

- If the value of the matching increases you must decrease the capacitance
- If it decreases you must increase the capacitance

Decrease or increase the capacitors by a small amount, then repeat the test checking if the deepness of the peak is at least 20 dB.

Quit the TX coil test and remove the circuit from the gantry to solder other capacitors and remember that: C4+C5 = C13+C14. It means that you must change at least two capacitors at a time

NOTICE C4+C5 value must always be equal to the C13+C14 value

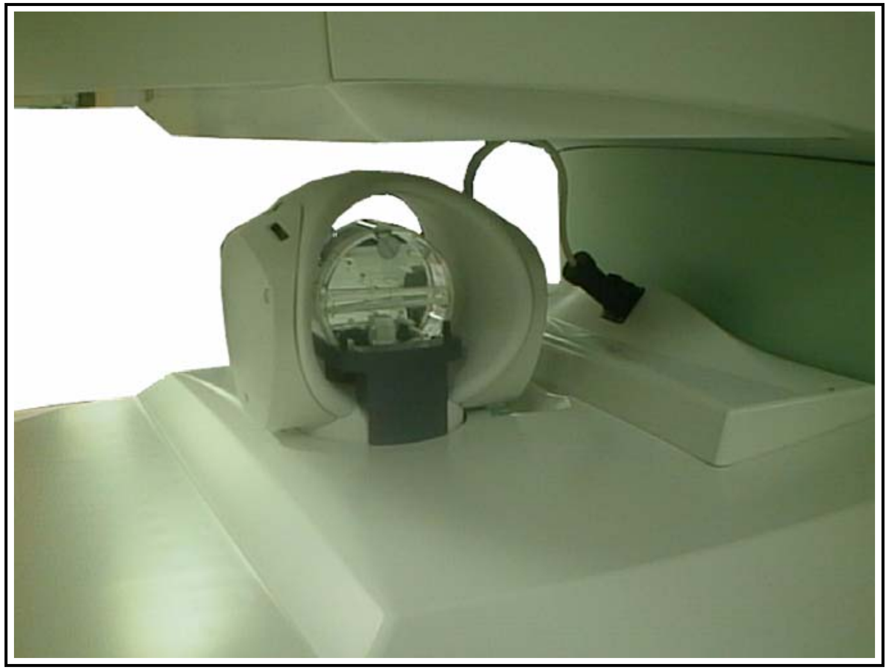
Repeat the test till you have the correct matching value.

NOTICE Verify that after reassembling the cover on the transmission circuits the TX peak is still in the correct position

Gradients Orientation Check

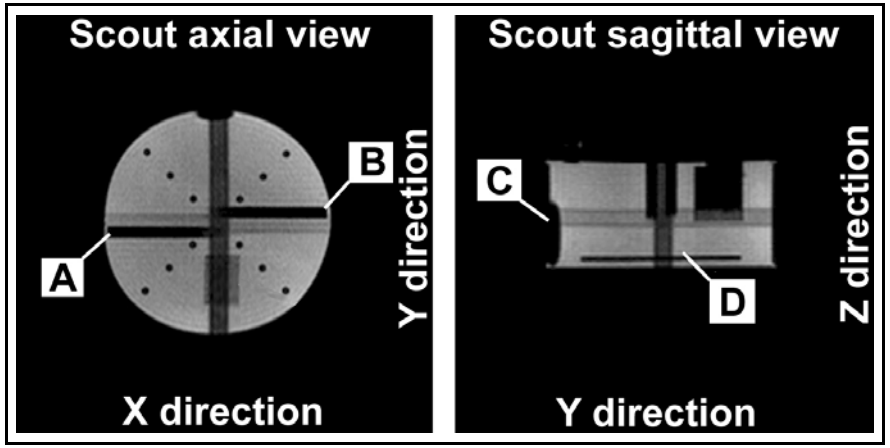
- Place the geometrical phantom in AXIAL position into the Knee coil taking care to place it with the plastic screw up to the right side of the magnet (patient bed position A), then insert the Knee coil into the magnet (like shown in the previous figure)

Fig. 257: Geometrical phantom in AXIAL position inside the magnet



- Perform a scout selecting the district **<Other>** and **<A>** bed patient
- Compare the first two scout images (axial and sagittal) to the images shown
  - If they have the same orientation fill in the “Calibration and Quality Form”
  - If they have a different orientation check the gradient cables looking for inversions then repeat this test until the correct scout images are obtained

Fig. 258: Scout images



- Fill in the **Installation Quality Form**

4th Channel Polarity Check

- Under ARAS select **<Test> <Troubleshoot.> <4 Ch. Polarity> <Exec>** and the system will perform automatically the polarity check of the 4th Channel looking for cable inversion
- The system will ask to insert the Knee Coil 2 and the small spherical phantom

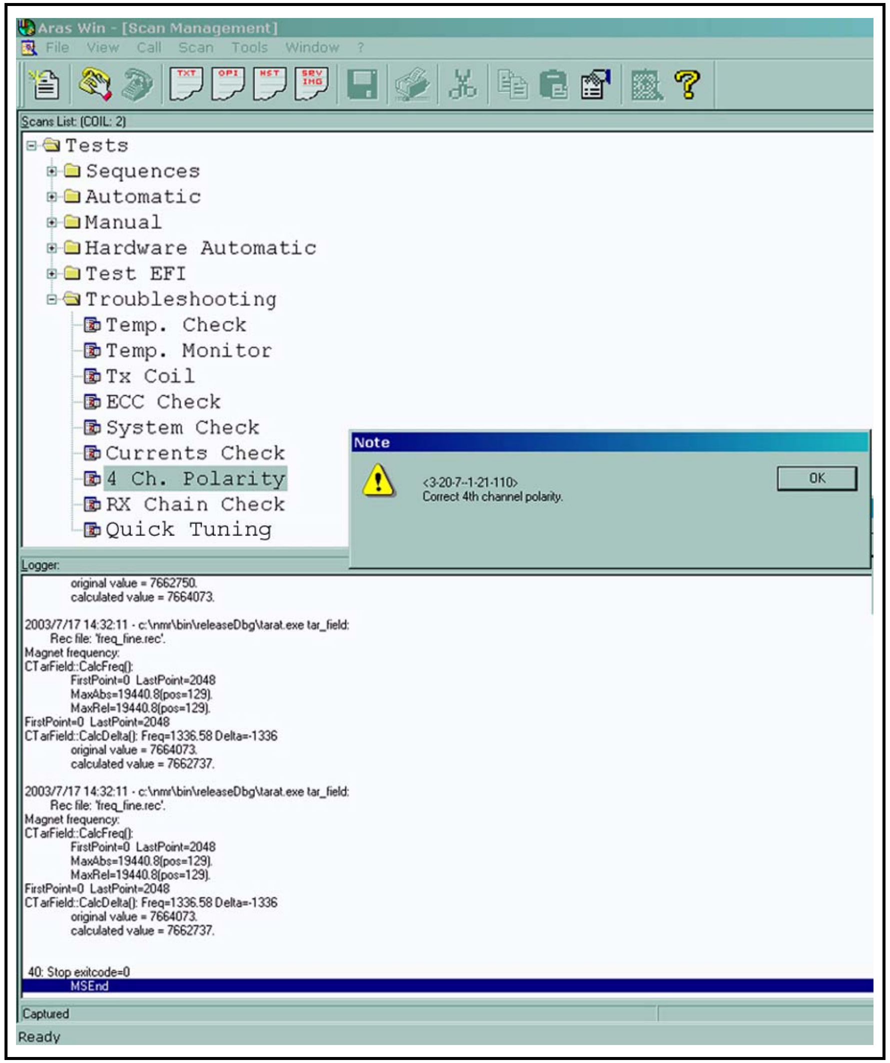
NOTICE	The system will show the Phase stability window message only in case of incorrect value, if the value is correct the procedure will continue automatically. In case of Phase Stability problem perform the magnetic compensation procedure then calibrate the System

- If any inversion is present the system will show you a correct polarity message. In case of inversion the system will show you a message with the opposite meaning: check the 4th channel cables connected to the SGRA and to the filter panel (internal and external side) looking for any inversion, then repeat the test

⚠**WARNING**	**In case of inversion, the Magnetic Compensation Procedure must be repeated because the 4th Ch Coil is used to perform the Magnetic Compensation**

- When the correct message is displayed, fill in the **Installation Quality Form**

Fig. 259: Test correct result



<3-20-7--1-21-110>
Correct 4th channel polarity.

```
          original value = 7662750.
          calculated value = 7664073.

2003/7/17 14:32:11 - c:\nmr\bin\releaseDbg\tarat.exe tar_field:
     Rec file: 'freq_fine.rec'.
Magnet frequency:
CTarField::CalcFreq():
          FirstPoint=0  LastPoint=2048
          MaxAbs=19440.8(pos=129).
          MaxRel=19440.8(pos=129).
FirstPoint=0  LastPoint=2048
CTarField::CalcDelta(): Freq=1336.58 Delta=-1336
          original value = 7664073.
          calculated value = 7662737.

2003/7/17 14:32:11 - c:\nmr\bin\releaseDbg\tarat.exe tar_field:
     Rec file: 'freq_fine.rec'.
Magnet frequency:
CTarField::CalcFreq():
          FirstPoint=0  LastPoint=2048
          MaxAbs=19440.8(pos=129).
          MaxRel=19440.8(pos=129).
FirstPoint=0  LastPoint=2048
CTarField::CalcDelta(): Freq=1336.58 Delta=-1336
          original value = 7664073.
          calculated value = 7662737.


 40: Stop exitcode=0
          MSEnd
```

- In case of no signal message check the system functionality (refer to the Service Manual)

SGRA Calibration Check

NOTICE	In case of: shimming, SGRA substitution and Gantry substitution you must perform the ECC Tune procedure. During the system installation the ECC Check procedure is enough to guarantee that the SGRA is correctly calibrated

ECC Check

The ECC Check procedure is a part of the ECC Tune procedure used to verify the correct SGRA calibration.

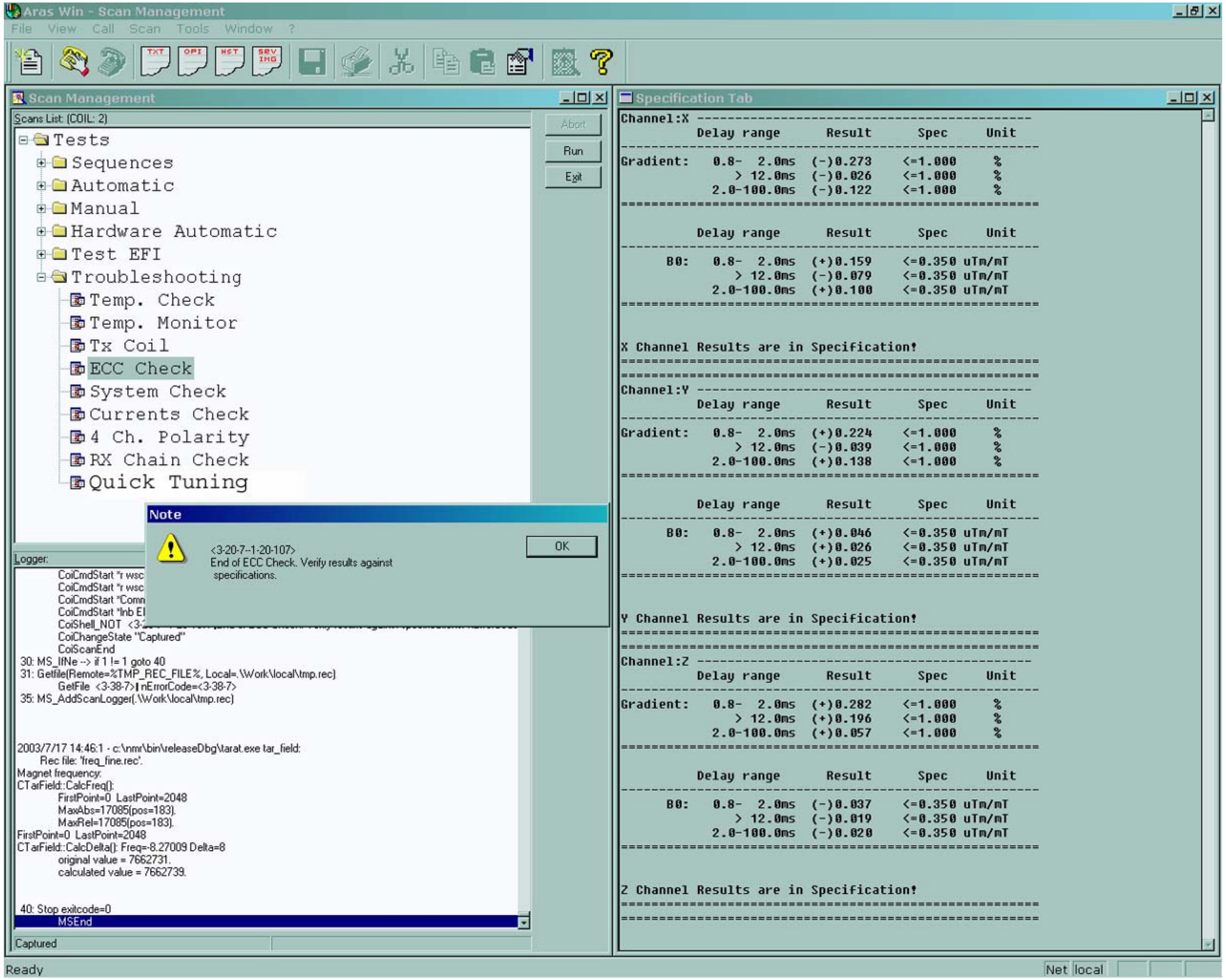
It takes only about 15 minutes to check the SGRA module while the ECC Tune procedure takes a bit more than 1 hour for the complete calibration.

- Insert the Knee Coil 2 with the Small Spherical phantom in it
- Perform one scout selecting the district **<Other>** and **<A>** bed patient
- Under ARAS select **<Test> <Troubleshoot.> <ECC Check> <Exec>** then follow the software instructions and the system will automatically check the SGRA module
- Now the system performs the Phase Stability check, and a warning message is shown only in case of problem otherwise the procedure continues automatically

NOTICE	The system will show the Phase stability window message only in case of incorrect value, if the value is correct the procedure will continue automatically. In case of Phase Stability problem perform the magnetic compensation procedure and repeat the ECC Check

- The system performs a automatic check of the Phantom position, an error message is shown only in case of problem asking you to re-set the Phantom position and in which direction you have to move it
- Now the system performs the ECC check for all the channels, wait for the end of calibration when the system shows the next figure
- After the complete calibration check the obtained values reading the result window. Use the scroll bar to read all the values: they must be under specification (an asterisk put in evidence the not correct values). If even one value is out of specification perform the ECC Tune procedure
- It's possible to read the obtained values also selecting the file **auto_eddy.rec** then scroll the file to read the X, Y, Z and 4th channel values. The values of the last performed check are in the bottom part of the file. If this file is opened during the calibration the system will not refresh it: quit and re-open the file to refresh it
- If the values are correct, fill in the **Installation Quality Form** with the saved values

Fig. 260: ECC Check result values



```
Channel:X -----------------------------------------
          Delay range      Result       Spec     Unit
-------------------------------------------------------
Gradient:   0.8-  2.0ms  (-)0.273    <=1.000     %
              > 12.0ms  (-)0.026    <=1.000     %
           2.0-100.0ms  (-)0.122    <=1.000     %
=======================================================

          Delay range      Result       Spec     Unit
-------------------------------------------------------
      B0:   0.8-  2.0ms  (+)0.159    <=0.350 uTm/mT
              > 12.0ms  (-)0.079    <=0.350 uTm/mT
           2.0-100.0ms  (+)0.100    <=0.350 uTm/mT
=======================================================


X Channel Results are in Specification!
=======================================================
=======================================================
Channel:Y -----------------------------------------
          Delay range      Result       Spec     Unit
-------------------------------------------------------
Gradient:   0.8-  2.0ms  (+)0.224    <=1.000     %
              > 12.0ms  (-)0.039    <=1.000     %
           2.0-100.0ms  (+)0.138    <=1.000     %
=======================================================

          Delay range      Result       Spec     Unit
-------------------------------------------------------
      B0:   0.8-  2.0ms  (+)0.046    <=0.350 uTm/mT
              > 12.0ms  (+)0.026    <=0.350 uTm/mT
           2.0-100.0ms  (+)0.025    <=0.350 uTm/mT
=======================================================


Y Channel Results are in Specification!
=======================================================
=======================================================
Channel:Z -----------------------------------------
          Delay range      Result       Spec     Unit
-------------------------------------------------------
Gradient:   0.8-  2.0ms  (+)0.282    <=1.000     %
              > 12.0ms  (+)0.196    <=1.000     %
           2.0-100.0ms  (+)0.057    <=1.000     %
=======================================================

          Delay range      Result       Spec     Unit
-------------------------------------------------------
      B0:   0.8-  2.0ms  (-)0.037    <=0.350 uTm/mT
              > 12.0ms  (-)0.019    <=0.350 uTm/mT
           2.0-100.0ms  (-)0.020    <=0.350 uTm/mT
=======================================================


Z Channel Results are in Specification!
=======================================================
=======================================================
```

<3-20-7--1-20-107>
End of ECC Check. Verify results against specifications.

```
        CoiCmdStart "r wsc
        CoiCmdStart "r wsc
        CoiCmdStart "Comn
        CoiCmdStart "Inb El
        CoiShell_NOT  <3-
        CoiChangeState "Captured"
        CoiScanEnd
 30: MS_IfNe --> if 1 != 1 goto 40
 31: Getfile(Remote=%TMP_REC_FILE%, Local=.\Work\local\tmp.rec)
        GetFile  <3-38-7>| nErrorCode=<3-38-7>
 35: MS_AddScanLogger(.\Work\local\tmp.rec)



2003/7/17 14:46:1 - c:\nmr\bin\releaseDbg\tarat.exe tar_field:
     Rec file: 'freq_fine.rec'.
Magnet frequency:
CTarField::CalcFreq():
        FirstPoint=0  LastPoint=2048
        MaxAbs=17085(pos=183).
        MaxRel=17085(pos=183).
FirstPoint=0  LastPoint=2048
CTarField::CalcDelta(): Freq=-8.27009 Delta=8
        original value = 7662731.
        calculated value = 7662739.


 40: Stop exitcode=0
        MSEnd
```

ECC Tune

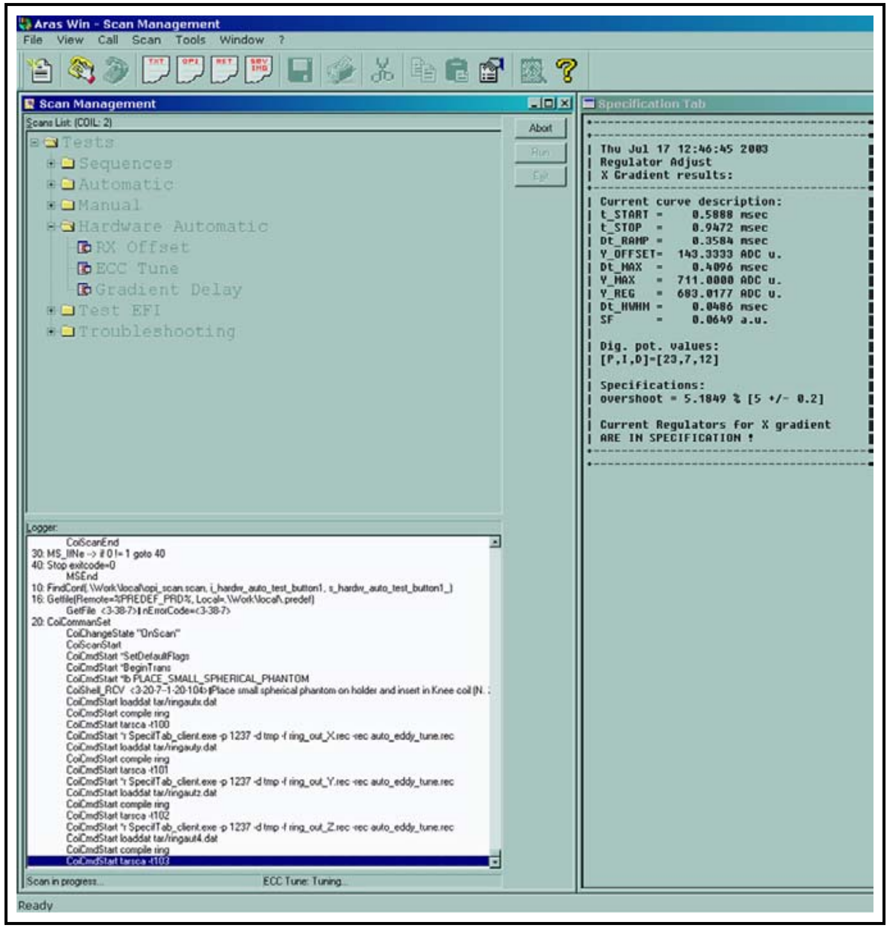
- Insert the Knee Coil 2 with the Small Spherical phantom in it
- Perform one scout selecting the district <Other> and <A> bed patient
- Under ARAS select **<Test> <HW Automatic> <ECC Tune> <Exec>** then follow the software instructions and the system will automatically calibrate the SGRA module. The automatic procedure comprehends: the Regulator calibrations (X, Y, Z and 4th channel), the Phase Stability check, the phantom position check (axial, sagittal and coronal images) and the ECC (acronym for eddy current compensation) tune

NOTICE	The system will show the Phase stability window message only in case of incorrect value, if the value is correct the procedure will continue automatically. In case of Phase Stability problem perform the magnetic compensation procedure and repeat the ECC Tune

NOTICE	If the procedure is aborted the values are not saved and the system restores the original values

- The system will ask you to insert the small spherical phantom into the Knee coil 2
- The first automatically step is the Regulator calibration: the system will show the regulator value after every channel calibration like shown in the following figures

Fig. 261: X channel regulator calibration message window

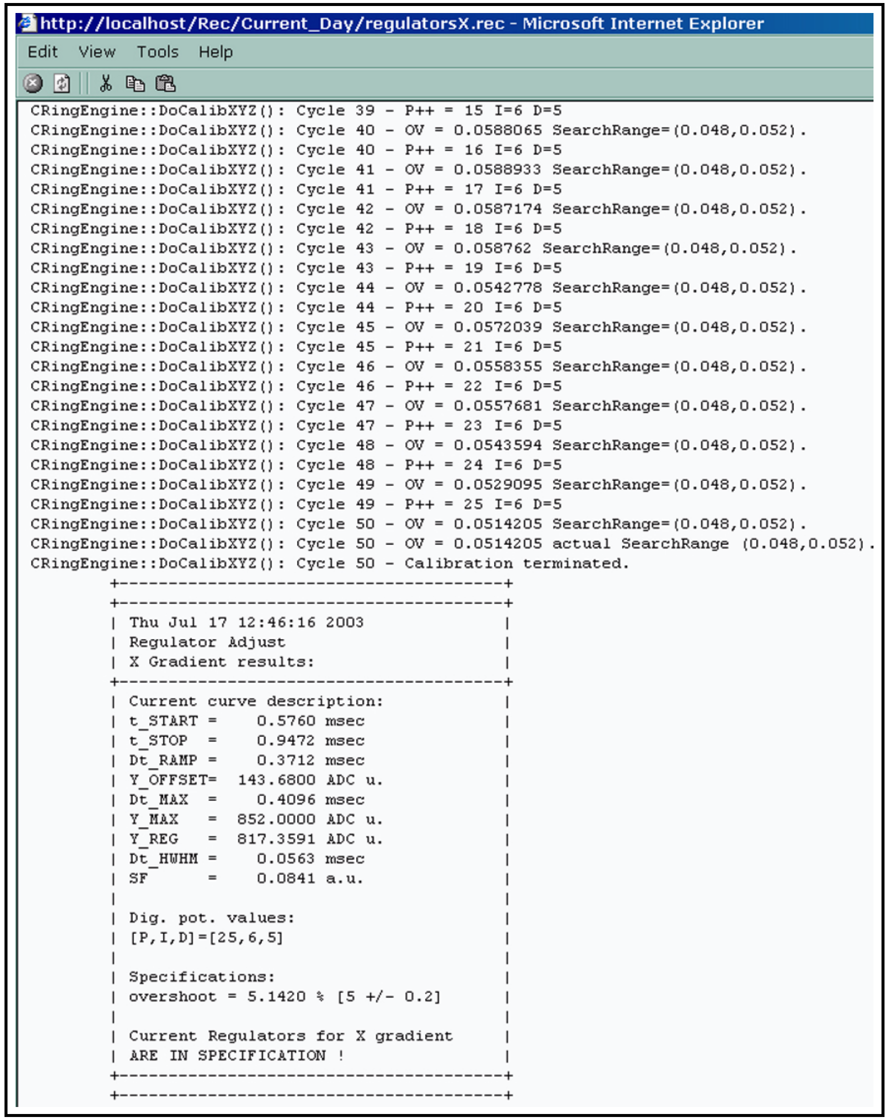


```
+--------------------------------------------
+--------------------------------------------
| Thu Jul 17 12:46:45 2003
| Regulator Adjust
| X Gradient results:
+--------------------------------------------
| Current curve description:
| t_START =    0.5888 msec
| t_STOP  =    0.9472 msec
| Dt_RAMP =    0.3584 msec
| Y_OFFSET=  143.3333 ADC u.
| Dt_MAX  =    0.4096 msec
| Y_MAX   =  711.0000 ADC u.
| Y_REG   =  683.0177 ADC u.
| Dt_HWHM =    0.0486 msec
| SF      =    0.0649 a.u.
|
| Dig. pot. values:
| [P,I,D]=[23,7,12]
|
| Specifications:
| overshoot = 5.1849 % [5 +/- 0.2]
|
| Current Regulators for X gradient
| ARE IN SPECIFICATION !
+--------------------------------------------
+--------------------------------------------
```

```
        CoiScanEnd
30: MS_IfNe -> if 0 != 1 goto 40
40: Stop exitcode=0
        MSEnd
10: FindConf(.\Work\local\opi_scan.scan, i_hardw_auto_test_button1, s_hardw_auto_test_button1_)
16: Getfile(Remote=%PREDEF_PRD%, Local=.\Work\local\.predef)
        GetFile  <3-38-7>|nErrorCode=<3-38-7>
20: CoiCommanSet
        CoiChangeState "OnScan"
        CoiScanStart
        CoiCmdStart "SetDefaultFlags
        CoiCmdStart "BeginTrans
        CoiCmdStart "lb PLACE_SMALL_SPHERICAL_PHANTOM
        CoiShell_RCV  <3-20-7-1-20-104>|Place small spherical phantom on holder and insert in Knee coil (N. :
        CoiCmdStart loaddat tar/ringautx.dat
        CoiCmdStart compile ring
        CoiCmdStart tarsca -t100
        CoiCmdStart "r SpecifTab_client.exe -p 1237 -d tmp -f ring_out_X.rec -rec auto_eddy_tune.rec
        CoiCmdStart loaddat tar/ringauty.dat
        CoiCmdStart compile ring
        CoiCmdStart tarsca -t101
        CoiCmdStart "r SpecifTab_client.exe -p 1237 -d tmp -f ring_out_Y.rec -rec auto_eddy_tune.rec
        CoiCmdStart loaddat tar/ringautz.dat
        CoiCmdStart compile ring
        CoiCmdStart tarsca -t102
        CoiCmdStart "r SpecifTab_client.exe -p 1237 -d tmp -f ring_out_Z.rec -rec auto_eddy_tune.rec
        CoiCmdStart loaddat tar/ringaut4.dat
        CoiCmdStart compile ring
        CoiCmdStart tarsca -t103
```

- After the complete calibration it's possible to check the Regulator obtained values reading the **regulatorsX.rec** (and Y, Z and IV CH of course) file and scrolling it to read the Channel values. If this file is opened during the calibration the system will not refresh it: quit and re-open the file to refresh it

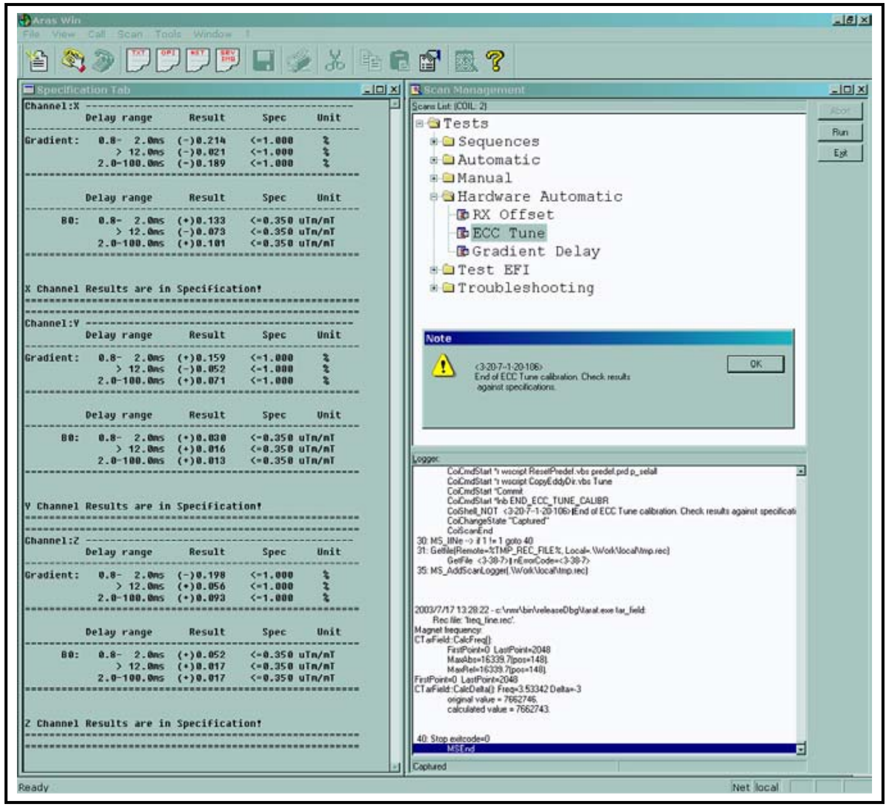
Fig. 262: Regulators4.rec


http://localhost/Rec/Current_Day/regulatorsX.rec - Microsoft Internet Explorer
Edit
View
Tools
Help

```
CRingEngine::DoCalibXYZ(): Cycle 39 - P++ = 15 I=6 D=5
CRingEngine::DoCalibXYZ(): Cycle 40 - OV = 0.0588065 SearchRange=(0.048,0.052).
CRingEngine::DoCalibXYZ(): Cycle 40 - P++ = 16 I=6 D=5
CRingEngine::DoCalibXYZ(): Cycle 41 - OV = 0.0588933 SearchRange=(0.048,0.052).
CRingEngine::DoCalibXYZ(): Cycle 41 - P++ = 17 I=6 D=5
CRingEngine::DoCalibXYZ(): Cycle 42 - OV = 0.0587174 SearchRange=(0.048,0.052).
CRingEngine::DoCalibXYZ(): Cycle 42 - P++ = 18 I=6 D=5
CRingEngine::DoCalibXYZ(): Cycle 43 - OV = 0.058762 SearchRange=(0.048,0.052).
CRingEngine::DoCalibXYZ(): Cycle 43 - P++ = 19 I=6 D=5
CRingEngine::DoCalibXYZ(): Cycle 44 - OV = 0.0542778 SearchRange=(0.048,0.052).
CRingEngine::DoCalibXYZ(): Cycle 44 - P++ = 20 I=6 D=5
CRingEngine::DoCalibXYZ(): Cycle 45 - OV = 0.0572039 SearchRange=(0.048,0.052).
CRingEngine::DoCalibXYZ(): Cycle 45 - P++ = 21 I=6 D=5
CRingEngine::DoCalibXYZ(): Cycle 46 - OV = 0.0558355 SearchRange=(0.048,0.052).
CRingEngine::DoCalibXYZ(): Cycle 46 - P++ = 22 I=6 D=5
CRingEngine::DoCalibXYZ(): Cycle 47 - OV = 0.0557681 SearchRange=(0.048,0.052).
CRingEngine::DoCalibXYZ(): Cycle 47 - P++ = 23 I=6 D=5
CRingEngine::DoCalibXYZ(): Cycle 48 - OV = 0.0543594 SearchRange=(0.048,0.052).
CRingEngine::DoCalibXYZ(): Cycle 48 - P++ = 24 I=6 D=5
CRingEngine::DoCalibXYZ(): Cycle 49 - OV = 0.0529095 SearchRange=(0.048,0.052).
CRingEngine::DoCalibXYZ(): Cycle 49 - P++ = 25 I=6 D=5
CRingEngine::DoCalibXYZ(): Cycle 50 - OV = 0.0514205 SearchRange=(0.048,0.052).
CRingEngine::DoCalibXYZ(): Cycle 50 - OV = 0.0514205 actual SearchRange (0.048,0.052).
CRingEngine::DoCalibXYZ(): Cycle 50 - Calibration terminated.
         +---------------------------------------+
         +---------------------------------------+
         | Thu Jul 17 12:46:16 2003              |
         | Regulator Adjust                      |
         | X Gradient results:                   |
         +---------------------------------------+
         | Current curve description:            |
         | t_START =    0.5760 msec              |
         | t_STOP  =    0.9472 msec              |
         | Dt_RAMP =    0.3712 msec              |
         | Y_OFFSET=  143.6800 ADC u.            |
         | Dt_MAX  =    0.4096 msec              |
         | Y_MAX   =  852.0000 ADC u.            |
         | Y_REG   =  817.3591 ADC u.            |
         | Dt_HWHM =    0.0563 msec              |
         | SF      =    0.0841 a.u.              |
         |                                       |
         | Dig. pot. values:                     |
         | [P,I,D]=[25,6,5]                      |
         |                                       |
         | Specifications:                       |
         | overshoot = 5.1420 % [5 +/- 0.2]      |
         |                                       |
         | Current Regulators for X gradient     |
         | ARE IN SPECIFICATION !                |
         +---------------------------------------+
         +---------------------------------------+
```

- Now the system performs the Phase Stability check. An error message is shown just in case of problem, otherwise the procedure goes on automatically. In case of Phase Stability problem perform the magnetic compensation procedure and repeat the ECC Tune
- The system performs a automatic check of the Phantom position, an error message is shown only in case of problem asking you to re-set the Phantom position and in which direction you have to move it
- The system performs the ECC calibration for every channel and shows the result as soon as they are available
- Wait for the end of calibration (1 hour) when the system completes the shown table like in the next figure. The values are automatically saved. Use the scroll bar to read all the values: they must be under specification (an asterisk put in evidence the not correct values)

Fig. 263: ECC Tune results



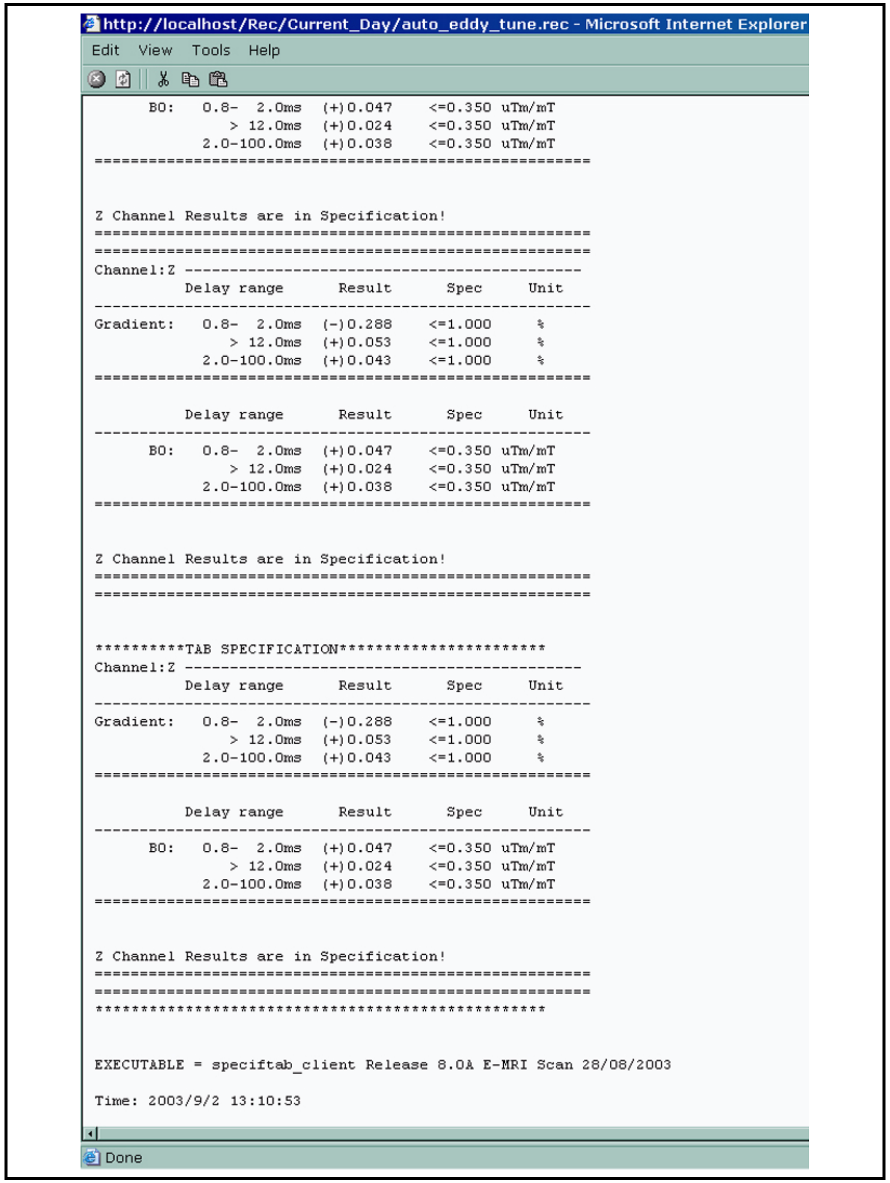
```
Channel:X ----------------------------------------------
          Delay range       Result      Spec     Unit
--------------------------------------------------------
Gradient:   0.8-  2.0ms  (-)0.214    <=1.000     %
              > 12.0ms  (-)0.021    <=1.000     %
            2.0-100.0ms  (-)0.189    <=1.000     %
========================================================

          Delay range       Result      Spec     Unit
--------------------------------------------------------
      B0:   0.8-  2.0ms  (+)0.133    <=0.350 uTm/mT
              > 12.0ms  (-)0.073    <=0.350 uTm/mT
            2.0-100.0ms  (+)0.101    <=0.350 uTm/mT
========================================================


X Channel Results are in Specification!
========================================================
========================================================
Channel:Y ----------------------------------------------
          Delay range       Result      Spec     Unit
--------------------------------------------------------
Gradient:   0.8-  2.0ms  (+)0.159    <=1.000     %
              > 12.0ms  (-)0.052    <=1.000     %
            2.0-100.0ms  (+)0.071    <=1.000     %
========================================================

          Delay range       Result      Spec     Unit
--------------------------------------------------------
      B0:   0.8-  2.0ms  (+)0.030    <=0.350 uTm/mT
              > 12.0ms  (+)0.016    <=0.350 uTm/mT
            2.0-100.0ms  (+)0.013    <=0.350 uTm/mT
========================================================


Y Channel Results are in Specification!
========================================================
========================================================
Channel:Z ----------------------------------------------
          Delay range       Result      Spec     Unit
--------------------------------------------------------
Gradient:   0.8-  2.0ms  (-)0.198    <=1.000     %
              > 12.0ms  (+)0.056    <=1.000     %
            2.0-100.0ms  (+)0.093    <=1.000     %
========================================================

          Delay range       Result      Spec     Unit
--------------------------------------------------------
      B0:   0.8-  2.0ms  (+)0.052    <=0.350 uTm/mT
              > 12.0ms  (+)0.017    <=0.350 uTm/mT
            2.0-100.0ms  (+)0.017    <=0.350 uTm/mT
========================================================


Z Channel Results are in Specification!
========================================================
========================================================
```

<3-20-7-1-20-106>
End of ECC Tune calibration. Check results against specifications.

```
        CoiCmdStart "r wscript ResetPredef.vbs predef.prd p_selall
        CoiCmdStart "r wscript CopyEddyDir.vbs Tune
        CoiCmdStart "Commit
        CoiCmdStart "Inb END_ECC_TUNE_CALIBR
        CoiShell_NOT  <3-20-7-1-20-106>|End of ECC Tune calibration. Check results against specificat
        CoiChangeState "Captured"
        CoiScanEnd
 30: MS_IfNe -> if 1 != 1 goto 40
 31: GetFile(Remote=%TMP_REC_FILE%, Local=.\Work\local\tmp.rec)
        GetFile  <3-38-7>|nErrorCode=<3-38-7>
 35: MS_AddScanLogger(.\Work\local\tmp.rec)


2003/7/17 13:28:22 - c:\nmr\bin\releaseDbg\aral.exe far_field
     Rec file: 'freq_fine.rec'.
Magnet frequency:
CTarField::CalcFreq()
        FirstPoint=0  LastPoint=2048
        MaxAbs=16339.7(pos=148).
        MaxRel=16339.7(pos=148).
FirstPoint=0  LastPoint=2048
CTarField::CalcDelta() Freq=3.53342 Delta=-3
        original value = 7662746.
        calculated value = 7662743.


 40: Stop exitcode=0
        MSEnd
```

- Fill in the **Installation Quality Form** with the saved values
- It's possible to read the obtained values also selecting the file **auto_eddy_tune.rec**, then scroll the file to read the X, Y, Z and 4th channel values. The values of the last performed check are in the bottom part of the file. If this file is opened during the calibration the system will not refresh it: quit and re-open the file to refresh it

Fig. 264: auto_eddy_tune.rec

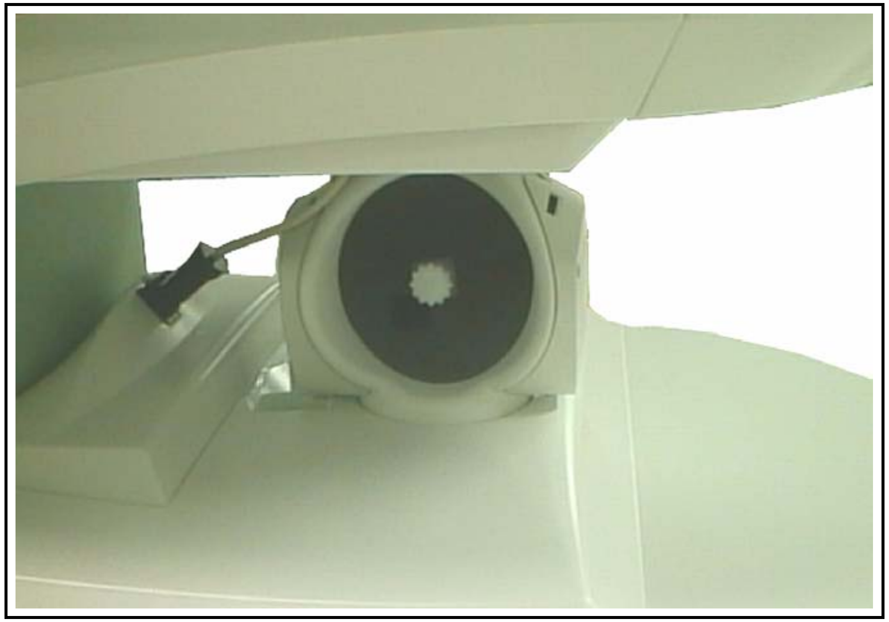

http://localhost/Rec/Current_Day/auto_eddy_tune.rec - Microsoft Internet Explorer
Edit View Tools Help
Done

```
      B0:   0.8-  2.0ms  (+)0.047    <=0.350 uTm/mT
              > 12.0ms  (+)0.024    <=0.350 uTm/mT
            2.0-100.0ms  (+)0.038    <=0.350 uTm/mT
========================================================


Z Channel Results are in Specification!
========================================================
========================================================
Channel:Z ----------------------------------------------
          Delay range       Result      Spec     Unit
--------------------------------------------------------
Gradient:   0.8-  2.0ms  (-)0.288    <=1.000     %
              > 12.0ms  (+)0.053    <=1.000     %
            2.0-100.0ms  (+)0.043    <=1.000     %
========================================================

          Delay range       Result      Spec     Unit
--------------------------------------------------------
      B0:   0.8-  2.0ms  (+)0.047    <=0.350 uTm/mT
              > 12.0ms  (+)0.024    <=0.350 uTm/mT
            2.0-100.0ms  (+)0.038    <=0.350 uTm/mT
========================================================


Z Channel Results are in Specification!
========================================================
========================================================


**********TAB SPECIFICATION**********************
Channel:Z ----------------------------------------------
          Delay range       Result      Spec     Unit
--------------------------------------------------------
Gradient:   0.8-  2.0ms  (-)0.288    <=1.000     %
              > 12.0ms  (+)0.053    <=1.000     %
            2.0-100.0ms  (+)0.043    <=1.000     %
========================================================

          Delay range       Result      Spec     Unit
--------------------------------------------------------
      B0:   0.8-  2.0ms  (+)0.047    <=0.350 uTm/mT
              > 12.0ms  (+)0.024    <=0.350 uTm/mT
            2.0-100.0ms  (+)0.038    <=0.350 uTm/mT
========================================================


Z Channel Results are in Specification!
========================================================
========================================================
**************************************************


EXECUTABLE = speciftab_client Release 8.0A E-MRI Scan 28/08/2003

Time: 2003/9/2 13:10:53
```

Gradient Delay Adjustment

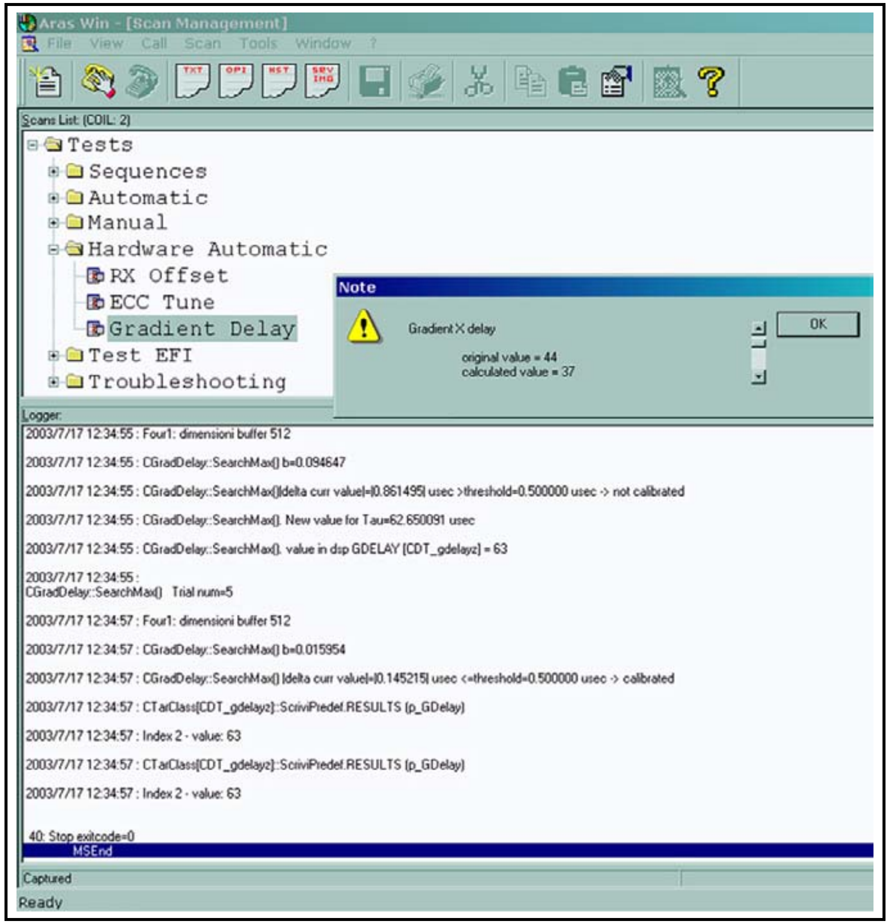
- Insert into the Knee Coil 2 the ghosting phantom (in central position) using its support. Like shown in the next figure

Fig. 265: Ghosting Phantom position



- Perform the Gradient delay calibration selecting, under ARAS, **<Test> <HW Automatic> <Gradient Delay> <Exec>**. The system automatically finds and save the best G-Readout value for every sequence

Fig. 266: Gradient Delay automatic calibration

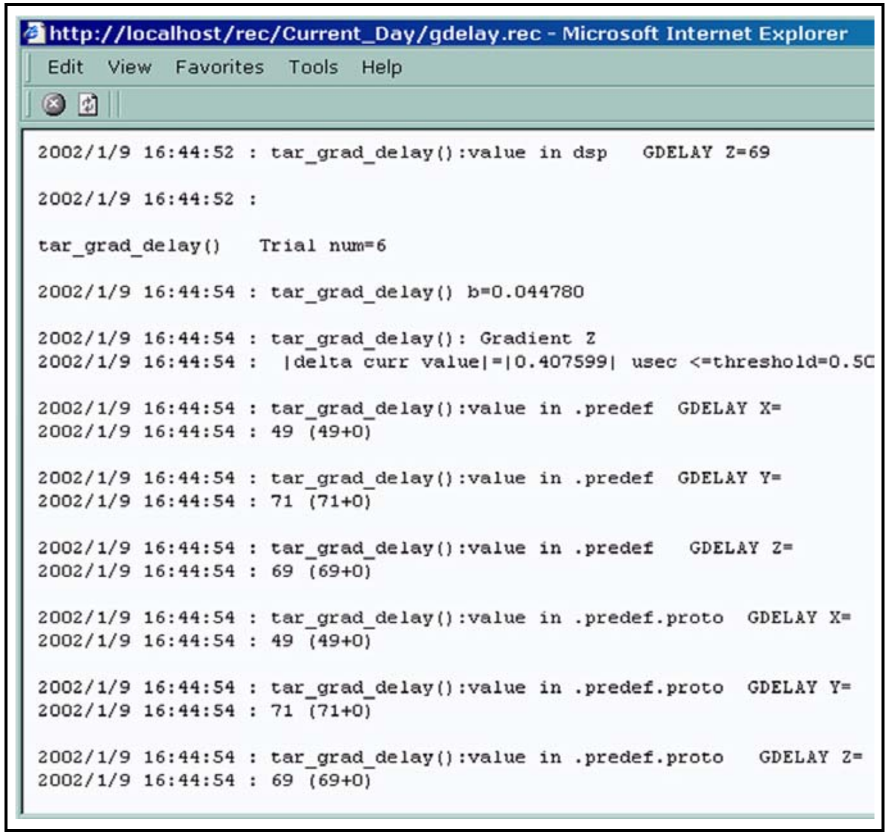


```
Gradient X delay

        original value = 44
        calculated value = 37
```

```
2003/7/17 12:34:55 : Four1: dimensioni buffer 512

2003/7/17 12:34:55 : CGradDelay::SearchMax() b=0.094647

2003/7/17 12:34:55 : CGradDelay::SearchMax()|delta curr value|=|0.861495| usec >threshold=0.500000 usec -> not calibrated

2003/7/17 12:34:55 : CGradDelay::SearchMax(). New value for Tau=62.650091 usec

2003/7/17 12:34:55 : CGradDelay::SearchMax(). value in dsp GDELAY [CDT_gdelayz] = 63

2003/7/17 12:34:55 :
CGradDelay::SearchMax()   Trial num=5

2003/7/17 12:34:57 : Four1: dimensioni buffer 512

2003/7/17 12:34:57 : CGradDelay::SearchMax() b=0.015954

2003/7/17 12:34:57 : CGradDelay::SearchMax() |delta curr value|=|0.145215| usec <=threshold=0.500000 usec -> calibrated

2003/7/17 12:34:57 : CTarClass[CDT_gdelayz]::ScriviPredef.RESULTS (p_GDelay)

2003/7/17 12:34:57 : Index 2 - value: 63

2003/7/17 12:34:57 : CTarClass[CDT_gdelayz]::ScriviPredef.RESULTS (p_GDelay)

2003/7/17 12:34:57 : Index 2 - value: 63


 40: Stop exitcode=0
        MSEnd
```

- In case of incorrect position message, check the phantom position especially along the Z-axis. If the error is still present, go ahead with the Calibration
- Fill in the **Installation Quality Form** with the saved values
- The corresponding rec file is called **gdelay.rec**

Fig. 267: Gradient Delay rec



http://localhost/rec/Current_Day/gdelay.rec - Microsoft Internet Explorer
Edit View Favorites Tools Help

```
2002/1/9 16:44:52 : tar_grad_delay():value in dsp   GDELAY Z=69

2002/1/9 16:44:52 :

tar_grad_delay()   Trial num=6

2002/1/9 16:44:54 : tar_grad_delay() b=0.044780

2002/1/9 16:44:54 : tar_grad_delay(): Gradient Z
2002/1/9 16:44:54 :  |delta curr value|=|0.407599| usec <=threshold=0.5

2002/1/9 16:44:54 : tar_grad_delay():value in .predef  GDELAY X=
2002/1/9 16:44:54 : 49 (49+0)

2002/1/9 16:44:54 : tar_grad_delay():value in .predef  GDELAY Y=
2002/1/9 16:44:54 : 71 (71+0)

2002/1/9 16:44:54 : tar_grad_delay():value in .predef   GDELAY Z=
2002/1/9 16:44:54 : 69 (69+0)

2002/1/9 16:44:54 : tar_grad_delay():value in .predef.proto  GDELAY X=
2002/1/9 16:44:54 : 49 (49+0)

2002/1/9 16:44:54 : tar_grad_delay():value in .predef.proto  GDELAY Y=
2002/1/9 16:44:54 : 71 (71+0)

2002/1/9 16:44:54 : tar_grad_delay():value in .predef.proto   GDELAY Z=
2002/1/9 16:44:54 : 69 (69+0)
```

Linear Gain Adjusting

Introduction

In order to check the image quality from the point of view of dimensional accuracy; use the pins fitted for this purpose in the geometrical phantom.

The distance between the pins of the various squares, as recorded in the calibration protocol, may be measured with the **<Profile>** tolls. To have it, open the image using ARAS then click on the mouse right button and select the **<Profile>** functionality from the obtained list

When checking the distance between two points, a short statistical table is shown.

The following measurements are taken on the pixels of the profile between the two edges:

- **Dist.** = distance (mm) between the two edges
- **Delta** = difference of intensity from one edge to the other
- **Uniform.** = Percentage of uniformity of the signal
- **Mean** = mean value of the signal
- **Std. Dev.** = standard deviation of the signal

In all three cases, the squares formed by the pins must be parallel to the image edges so that horizontal and vertical distances can be measured perfectly.

When moving the phantom, it is recommended that the scout be repeated so as to ensure its exact position.

If errors exceeding the maximum permitted value occur, it is also necessary to check that there are no shimming problems, perhaps due to any ferrous objects placed inadvertently in the gantry.

Necessary Tools

– Geometrical Phantom and its supports

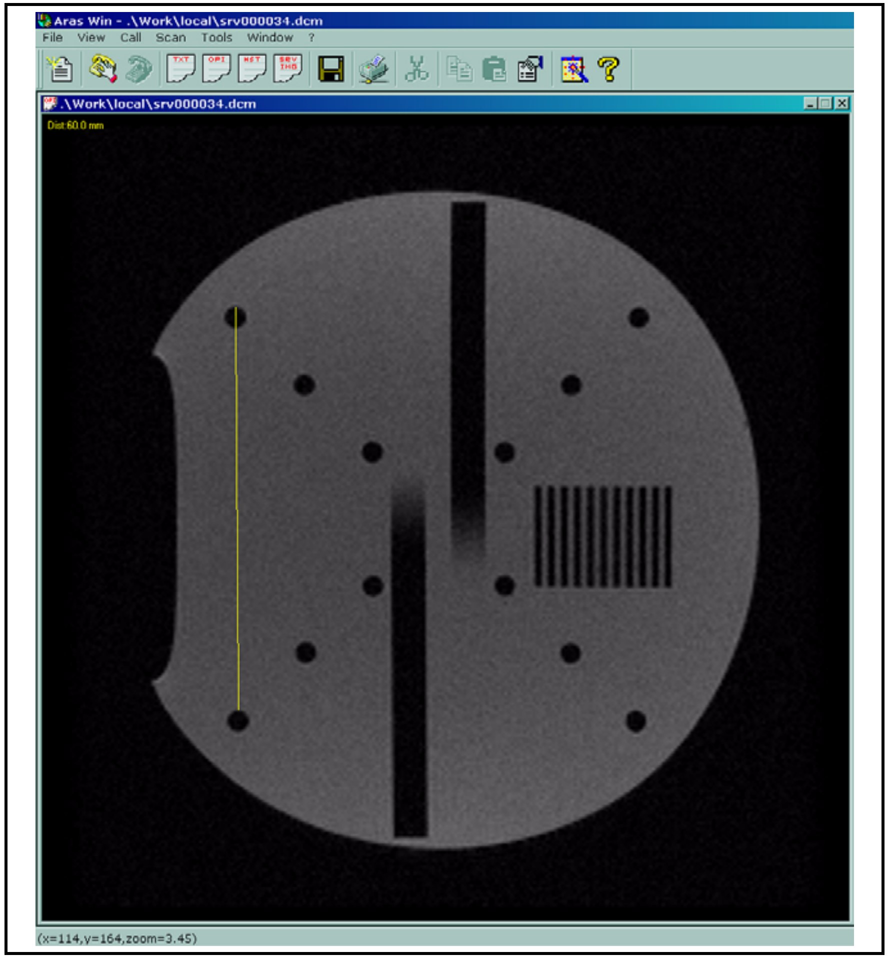
Operations

By adjusting the gradient gains, it is possible to change the relationship between actual dimensions and those rendered by the images. For this purpose, the geometrical phantom has been fitted with pins at a pre-set distance. After checking their distance in the medium and largest square (40 and 60 mm), modify the gains until the error obtained is below a tenth of a millimeter.

- Put the Geometrical Phantom in Axial position inside the Knee Coil 2 and perform one scout selecting the district **“Other”**
- Under OPI click on **<Protocol list>** and select the sequence **X GRADIENT GAIN CALIBRATION**
- When the images is obtained, load it from ARAS then select the **<Distance>** tool (right mouse button)
- Measure the **vertical** distance between the pins 40 and 60 mm and record them in the form (the image is Axial but rotated 90° CCW)
- If the measurement has an error exceeding 1% of the ideal value, adjust the gain of the X gradient. Under Internet Exploring select the **<Hardware Configuration>** page then change the **Linear Gain X** increasing or decreasing its value in according if the measured distance is smaller or bigger than the ideal one then save it. One digital step means between 0.2 and 0.4 mm (increase it to increase the distance and vice-versa)
- Repeat the measurements till to reach the specification

NOTICE	The reference values for the pins at 40 mm are: 39.6 mm ÷ 40.4 mm The reference values for the pins at 60 mm are: 59.4 mm ÷ 60.6 mm

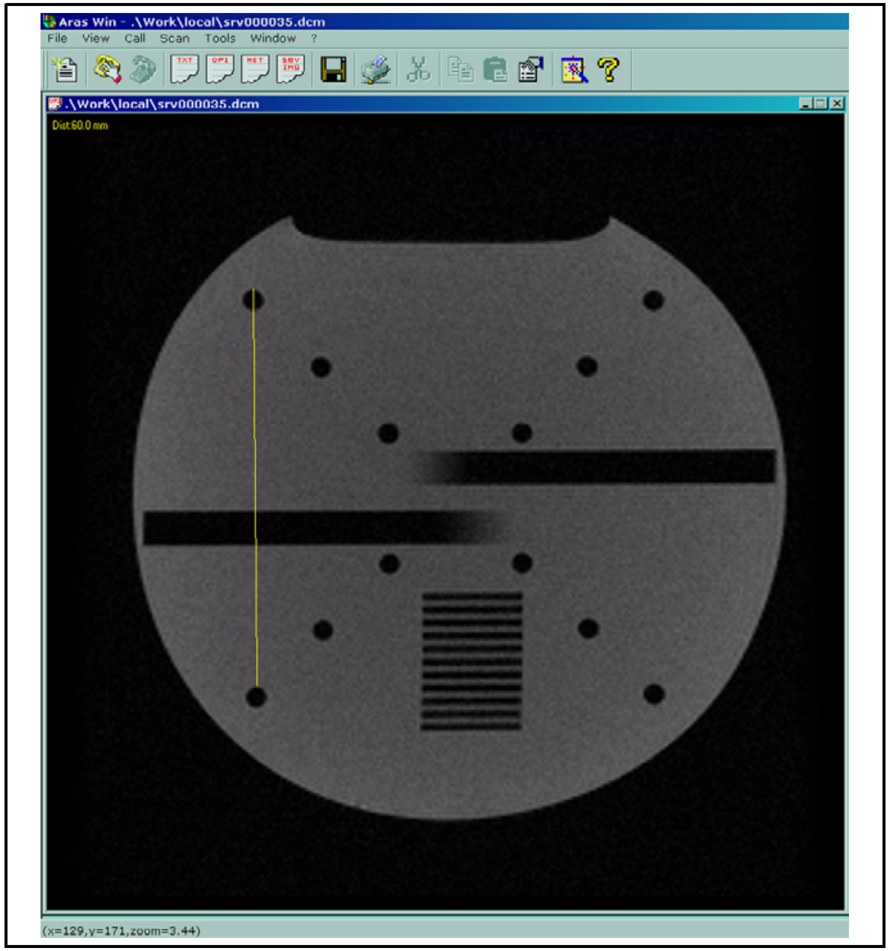
Fig. 268: X measurement


Aras Win - .\Work\local\srv000034.dcm
File View Call Scan Tools Window ?
.\Work\local\srv000034.dcm
Dist 60.0 mm
(x=114,y=164,zoom=3.45)

- Keep the phantom in the Axial position and acquire the sequence **Y GRADIENT GAIN CALIBRATION**
- When the images is obtained, load it from ARAS then select the **<Distance>** tool (right mouse button)

- Measure the **vertical** distance between the pins 40 and 60 mm and record them in the form

Fig. 269: Y measurement


Aras Win - .\Work\local\srv000035.dcm
File View Call Scan Tools Window ?
.\Work\local\srv000035.dcm
Dist 60.0 mm
(x=129,y=171,zoom=3.44)

- If the measurement has an error exceeding 1% of the ideal value, adjust the gain of the Y gradient. Under Internet Exploring select the **<Hardware Configuration>** page then change the **Linear Gain Y** increasing or decreasing its value in according if the measured distance is smaller or bigger than the ideal one then save it. One digital step means between 0.2 and 0.4 mm (increase it to increase the distance and vice-versa)
- Repeat the measurements till to reach the specification

NOTICE The reference values for the pins at 40 mm are: 39.6 mm ÷ 40.4 mm

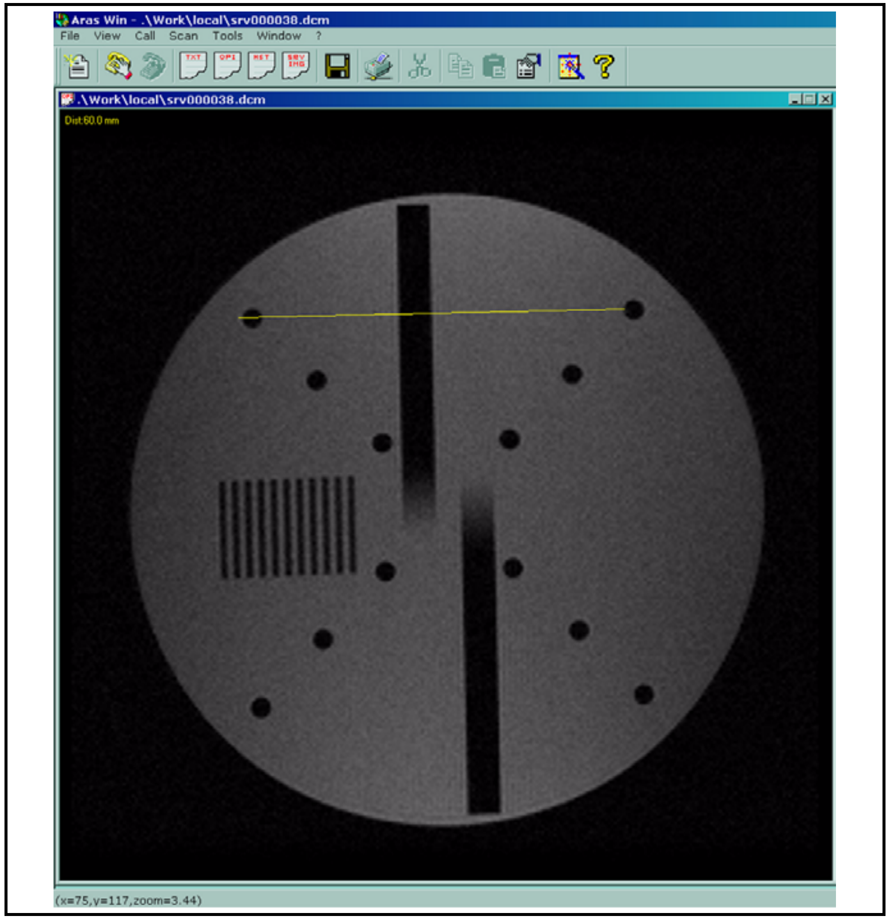
The reference values for the pins at 60 mm are: 59.4 mm ÷ 60.6 mm

- Place, the phantom in Coronal position, using the suitable support, and acquire the sequence: **4C__GRZ_GAIN: Z GRADIENT GAIN CALIBRATION**
- Select **<Service/Measurements>** and click on **<Profiles>**
- When the images is obtained, load it from ARAS then select the **<Distance>** tool (right mouse button)
- Measure the **horizontal** distance between the pins 40 and 60 mm and record them in the form
- If the measurement has an error exceeding 1% of the ideal value, adjust the gain of the Z gradient. Under Internet Exploring select the **<Hardware Configuration>** page then change the **Linear Gain Z** increasing or decreasing its value in according if the measured distance is smaller or bigger than the ideal one then save it. One digital step means between 0.2 and 0.4 mm (increase it to increase the distance and vice-versa)
- Repeat the measurements till to reach the specification

NOTICE The reference values for the pins at 40 mm are: 39.6 mm ÷ 40.4 mm

The reference values for the pins at 60 mm are: 59.4 mm ÷ 60.6 mm

Fig. 270: Z measurement



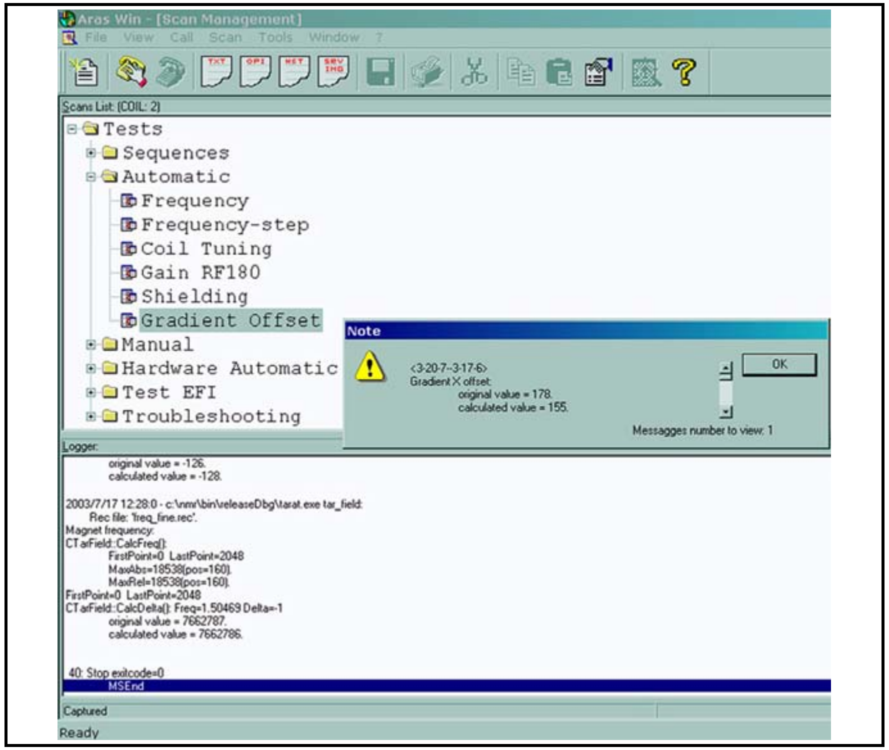
Aras Win - .\Work\local\srv000038.dcm
File View Call Scan Tools Window ?
TXT
OPI
MET
SRV IMG
.\Work\local\srv000038.dcm
Dist:60.0 mm
(x=75,y=117,zoom=3.44)

Gradient Offset Calibration

Perform this test only if you have done the automatic frequency calibration (not manual homogeneity) or if you have changed the values of X, Y or Z in the previous test (Linear Gain Adjustment)!!!

- Place the small spherical phantom into the Knee coil 2 and perform a Scout (district **<Other>** and the bed patient position **<A>**)
- Inside ARAS, select **<Test> <Automatic> <Gradient Offset> <Exec>**, the system will calibrate and save the gradient offsets and then will show the a correct calibration message

Fig. 271: System message

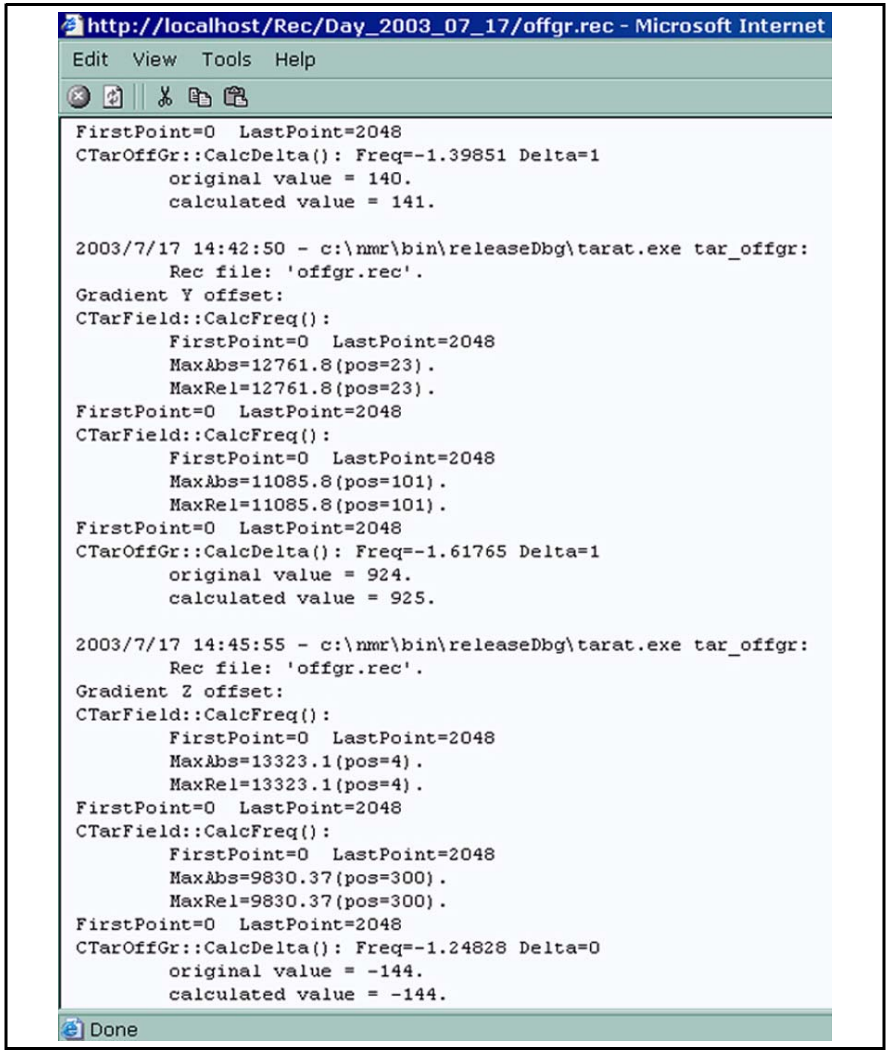


```
<3-20-7--3-17-6>
Gradient X offset:
        original value = 178.
        calculated value = 155.

Messagges number to view: 1
```

```
        original value = -126.
        calculated value = -128.

2003/7/17 12:28:0 - c:\nmr\bin\releaseDbg\tarat.exe tar_field:
     Rec file: 'freq_fine.rec'.
Magnet frequency:
CTarField::CalcFreq():
        FirstPoint=0  LastPoint=2048
        MaxAbs=18538(pos=160).
        MaxRel=18538(pos=160).
FirstPoint=0  LastPoint=2048
CTarField::CalcDelta(): Freq=1.50469 Delta=-1
        original value = 7662787.
        calculated value = 7662786.


 40: Stop exitcode=0
        MSEnd
```

- Fill in the **Installation Quality Form** with the saved values
- The corresponding rec file is called **offgr.rec**

Fig. 272: Gradient Offset Calibration rec file


http://localhost/Rec/Day_2003_07_17/offgr.rec - Microsoft Internet
Edit View Tools Help
Done

```
FirstPoint=0  LastPoint=2048
CTarOffGr::CalcDelta(): Freq=-1.39851 Delta=1
        original value = 140.
        calculated value = 141.

2003/7/17 14:42:50 - c:\nmr\bin\releaseDbg\tarat.exe tar_offgr:
        Rec file: 'offgr.rec'.
Gradient Y offset:
CTarField::CalcFreq():
        FirstPoint=0  LastPoint=2048
        MaxAbs=12761.8(pos=23).
        MaxRel=12761.8(pos=23).
FirstPoint=0  LastPoint=2048
CTarField::CalcFreq():
        FirstPoint=0  LastPoint=2048
        MaxAbs=11085.8(pos=101).
        MaxRel=11085.8(pos=101).
FirstPoint=0  LastPoint=2048
CTarOffGr::CalcDelta(): Freq=-1.61765 Delta=1
        original value = 924.
        calculated value = 925.

2003/7/17 14:45:55 - c:\nmr\bin\releaseDbg\tarat.exe tar_offgr:
        Rec file: 'offgr.rec'.
Gradient Z offset:
CTarField::CalcFreq():
        FirstPoint=0  LastPoint=2048
        MaxAbs=13323.1(pos=4).
        MaxRel=13323.1(pos=4).
FirstPoint=0  LastPoint=2048
CTarField::CalcFreq():
        FirstPoint=0  LastPoint=2048
        MaxAbs=9830.37(pos=300).
        MaxRel=9830.37(pos=300).
FirstPoint=0  LastPoint=2048
CTarOffGr::CalcDelta(): Freq=-1.24828 Delta=0
        original value = -144.
        calculated value = -144.
```

Shimming Check

Good homogeneity of the static field of the magnet is a necessary condition if you want to obtain good quality images. The shimming procedure carried out in the factory guarantees that magnetic field homogeneity is within specification when the magnet comes out from the factory.

However, due to several factors (transportation, storage etc.), the magnetic field may change, and the service operator might find that, on site, the homogeneity is not within specification anymore: this is due to the fact that some field coefficients (notably the second order coefficients) have increased.

The aim of this procedure is to detect and (if necessary) correct on site the second order coefficients of the magnetic field.

Use the Shimming kit and the Shimming Phantom to perform shimming adjustment.

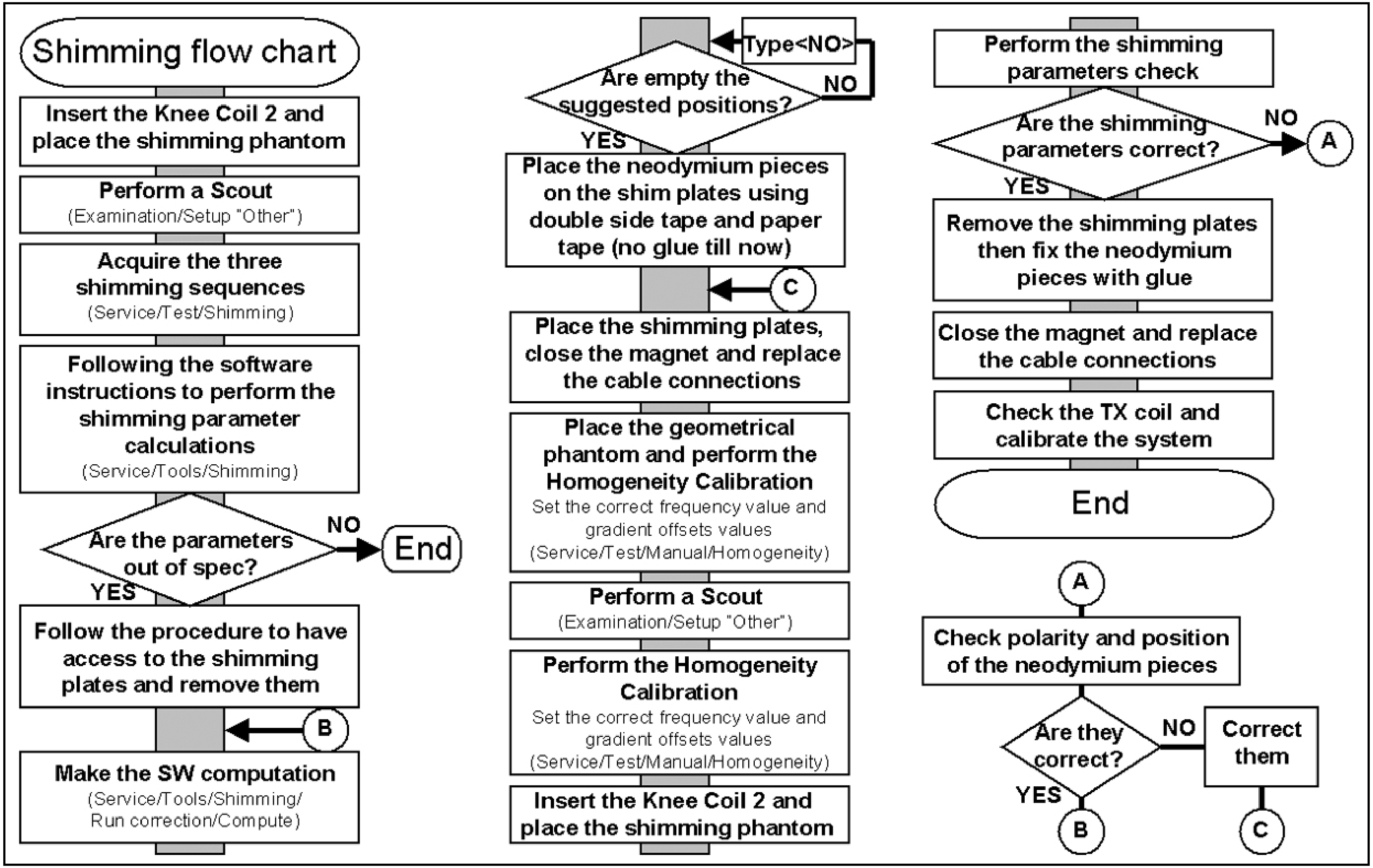
Tab. 7: Contents of the Shimming Phantom kit

Amount	Part No.	Dimensions
1	910 2163 000	Shimming Phantom
1	790 0000 275	Aluminum case

Tab. 8: Neodymium and spare screws contained into the Shimming kit

Amount	Part No.	Dimensions
64	810 5294 023	Neodymium 15.8 x 15.8 x 2.5
80	810 5294 022	Neodymium 12.3 x 12.3 x 2.5
80	810 5294 021	Neodymium 10.0 x 10.0 x 2.5
80	810 5294 020	Neodymium 10.0 x 5.0 x 2.5
240	810 5294 018	Neodymium 4.5 x 4.5 x 1.0
240	810 5294 017	Neodymium 4.2 x 4.2 x 1.0
200	810 5294 016	Neodymium 3.5 x 3.5 x 1.0
200	810 5294 015	Neodymium 2.7 x 2.7 x 1.0
80	810 5294 008	Neodymium 10.0 x 10.0 x 1.0
80	810 5294 007	Neodymium 10.0 x 7.5 x 1.0
160	810 5294 006	Neodymium 10.0 x 5.0 x 1.0
240	810 5294 005	Neodymium 5.0 x 5.0 x 1.0
200	810 5294 004	Neodymium 4.7 x 4.7 x 1.0
200	810 5294 003	Neodymium 3.9 x 3.9 x 1.0
200	810 5294 002	Neodymium 3.2 x 3.2 x 1.0
200	810 5294 001	Neodymium 2.2 x 2.2 x 1.0
5	060 0000 398	Gradient nylon screw M5 x 12
5	060 0000 414	Gradient nylon screw M5 x 30
10	060 0000 302	Screw M3 x 05
10	810 0195 003	Washer for screw M3

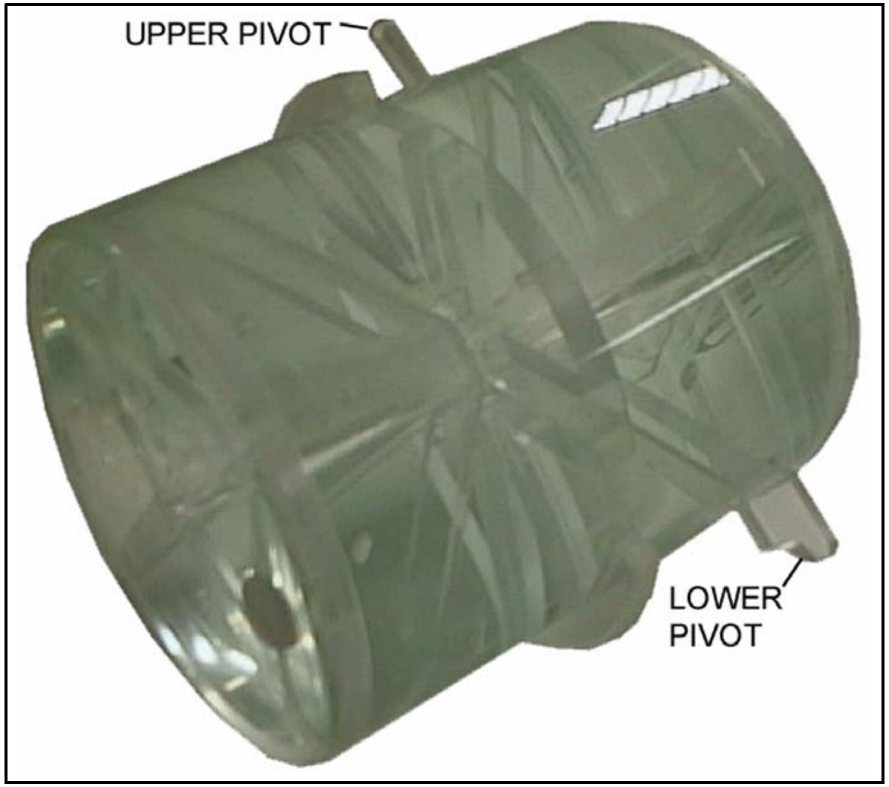
Fig. 273: Shimming Flowchart


Shimming flow chart
Insert the Knee Coil 2 and place the shimming phantom
Perform a Scout (Examination/Setup "Other")
Acquire the three shimming sequences (Service/Test/Shimming)
Following the software instructions to perform the shimming parameter calculations (Service/Tools/Shimming)
Are the parameters out of spec?
NO
End
YES
Follow the procedure to have access to the shimming plates and remove them
B
Make the SW computation (Service/Tools/Shimming/ Run correction/Compute)
Type<NO>
Are empty the suggested positions?
NO
YES
Place the neodymium pieces on the shim plates using double side tape and paper tape (no glue till now)
C
Place the shimming plates, close the magnet and replace the cable connections
Place the geometrical phantom and perform the Homogeneity Calibration
Set the correct frequency value and gradient offsets values (Service/Test/Manual/Homogeneity)
Perform a Scout (Examination/Setup "Other")
Perform the Homogeneity Calibration
Set the correct frequency value and gradient offsets values (Service/Test/Manual/Homogeneity)
Insert the Knee Coil 2 and place the shimming phantom
Perform the shimming parameters check
Are the shimming parameters correct?
NO
A
YES
Remove the shimming plates then fix the neodymium pieces with glue
Close the magnet and replace the cable connections
Check the TX coil and calibrate the system
End
A
Check polarity and position of the neodymium pieces
Are they correct?
NO
Correct them
YES
B
C

Phantom positioning

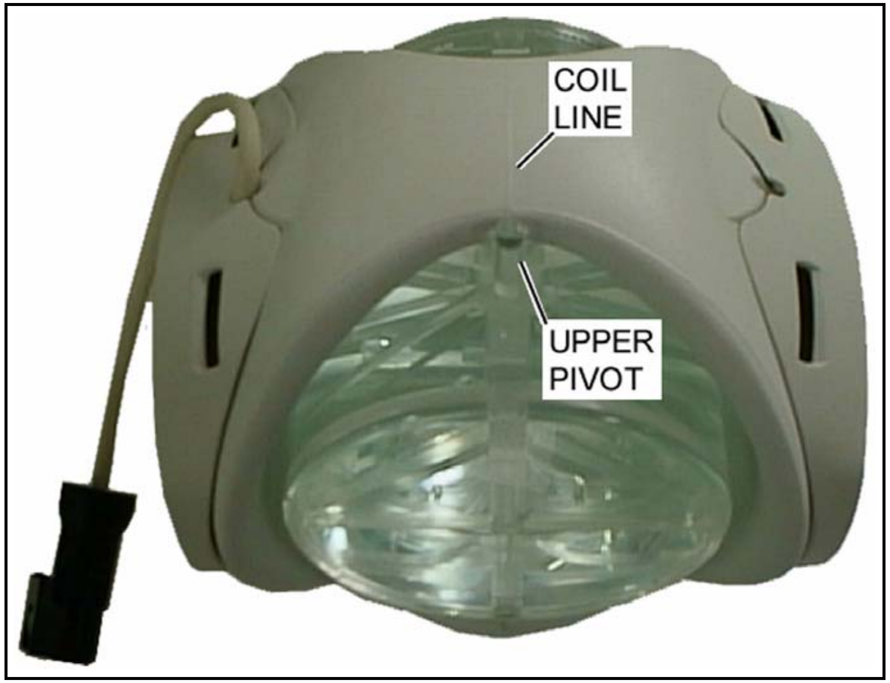
- Take the shimming phantom

Fig. 274: Shimming Phantom



- Place the shimming phantom into the Knee Coil 2 taking care to insert the pivot present in the phantom upper side perfectly along the coil line

Fig. 275: Shimming Phantom correctly inserted into the Knee Coil 2



- Check also if the lower pivot of the phantom is in contact with the coil

Fig. 276: Shimming Phantom correctly inserted into the Knee Coil 2

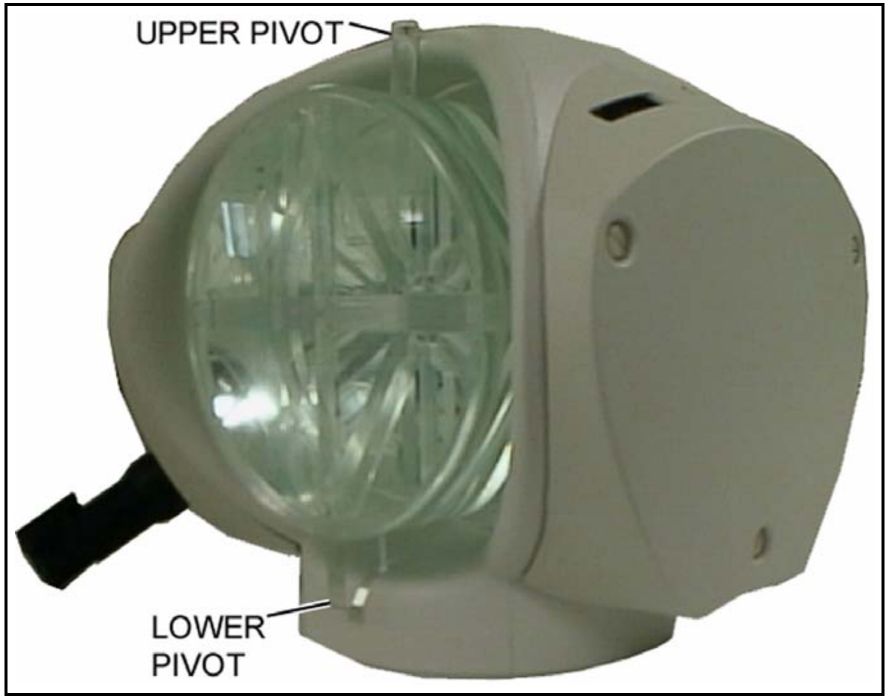
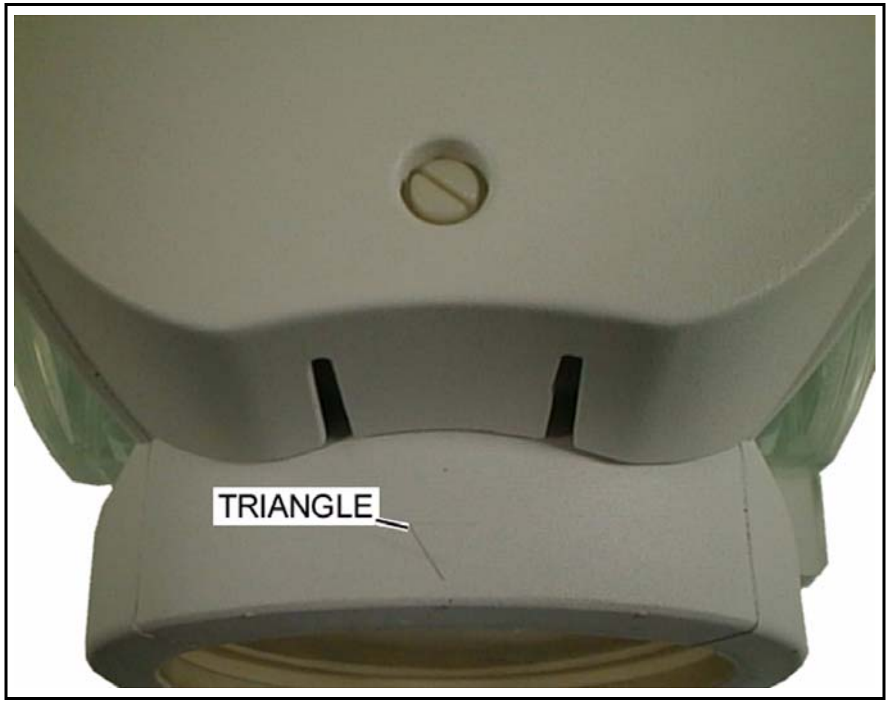
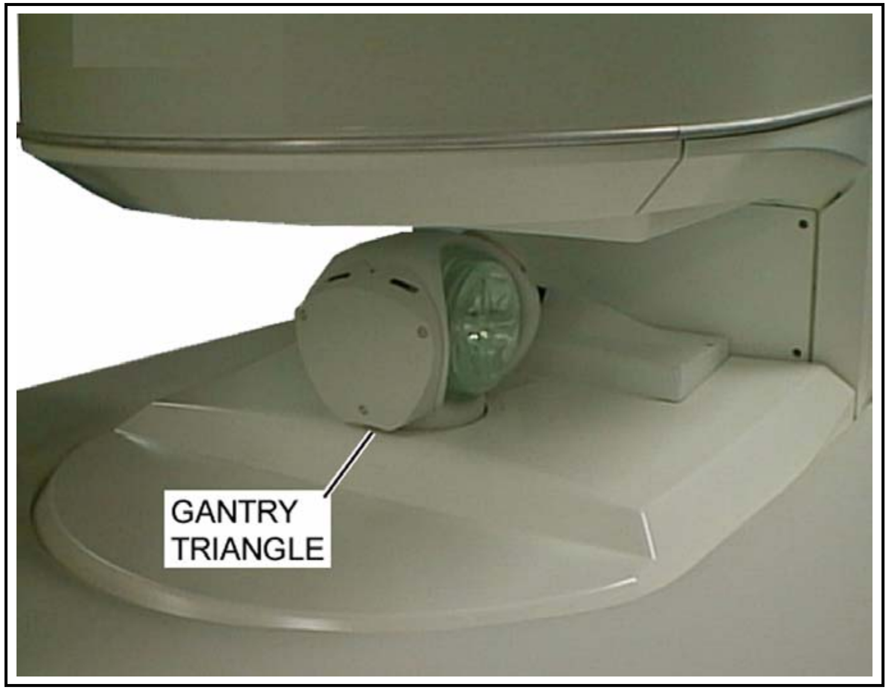


Fig. 277: Knee Coil 2



- Place the coil into the Gantry of the Magnet and connect it. The coil must be in the axial position: two triangles have been fitted (one on the coil base and one on the gantry). If the system doesn't have the triangle, refer to the following figures to place the phantom and the coil

Fig. 278: Knee Coil with Shimming phantom placed in Axial position



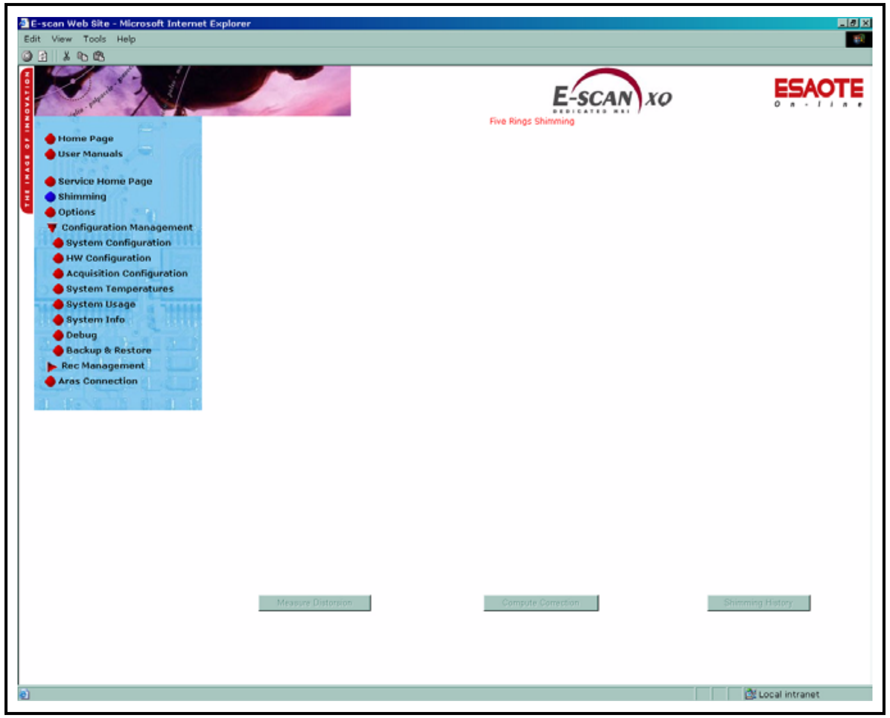
- In order to be certain that the phantom has been correctly positioned, the operator must perform a **Scout** sequence (select the district **OTHER** in the anatomy field and the bed patient position **A**) and check on the axial scout view if the vertical axis of the phantom is in vertical position then perform the shimming parameter acquisition

NOTICE	Perform the Transmission Coil Check before the scout

Shimming parameters acquisition

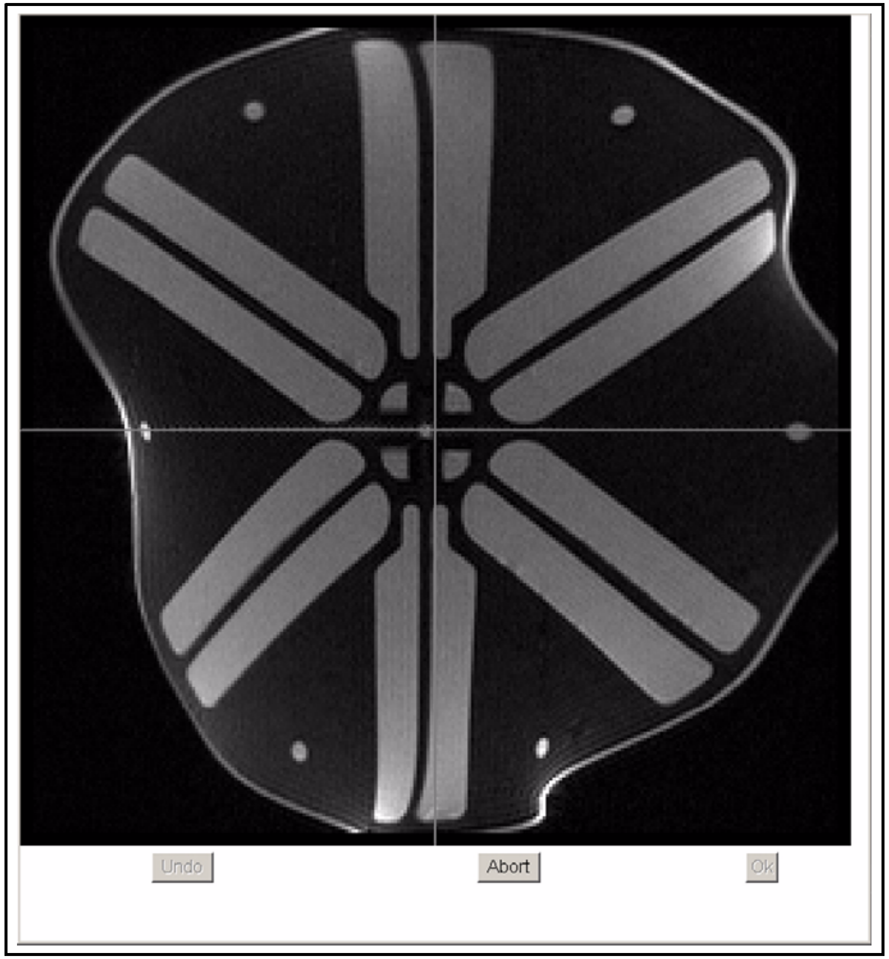
- Perform the shimming sequence acquisition selecting them from OPI inside **Protocol List, <Shimming>** folder (**Shimming Test Tra, Sag** and **Cor** sequences)
- When the three shimming phantom views have been obtained, the operator can access the shimming mask and perform the second order coefficients measurement opening Internet Explorer, **<Shimming>** Page

Fig. 279: Shimming page



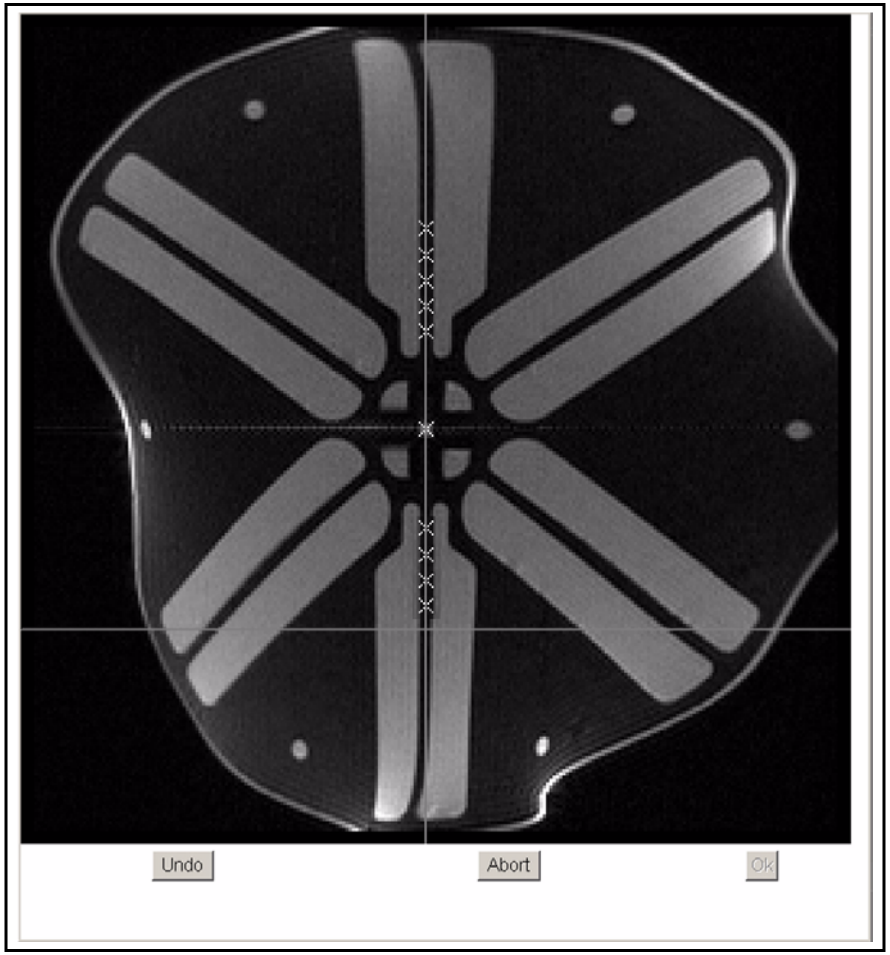
- Press the **Measure Distortion** button and the axial view will be automatically displayed

Fig. 280: Axial image



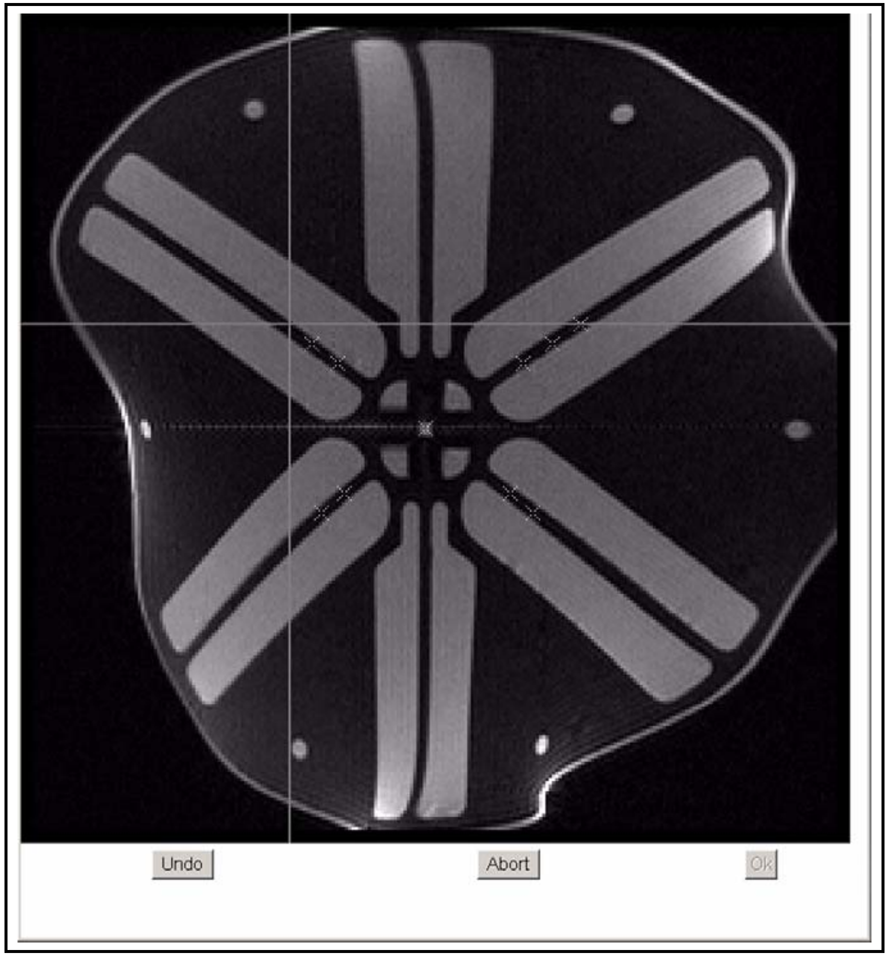
- Now, holding the mouse-right button, center the X prompt on the image center. When the X prompt is on the image center, release the mouse right button. Then, using the same method, align the X prompts along the image vertical axis (like shown in the next figure)

Fig. 281: X prompt centered on the image center



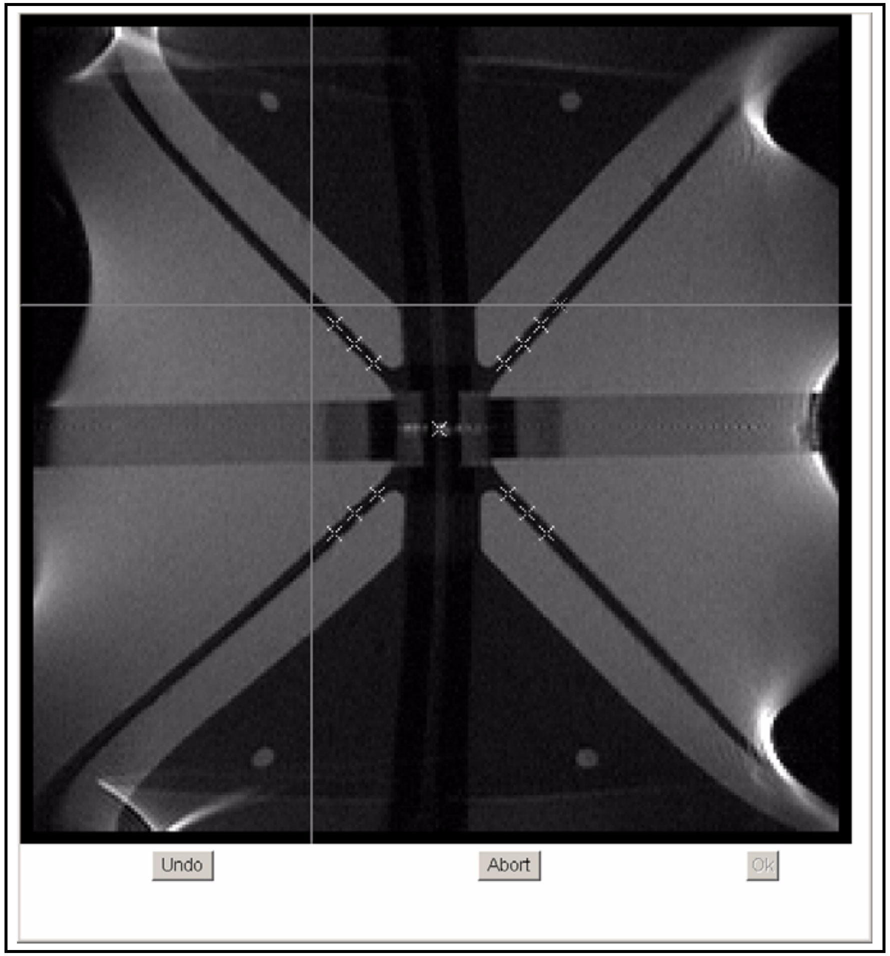
- When all the X prompts are correctly aligned click on the OK button and align the X prompts along the image diagonal axis otherwise click on the Undo button and repeat the alignment

Fig. 282: X prompts aligned on the image diagonal axis



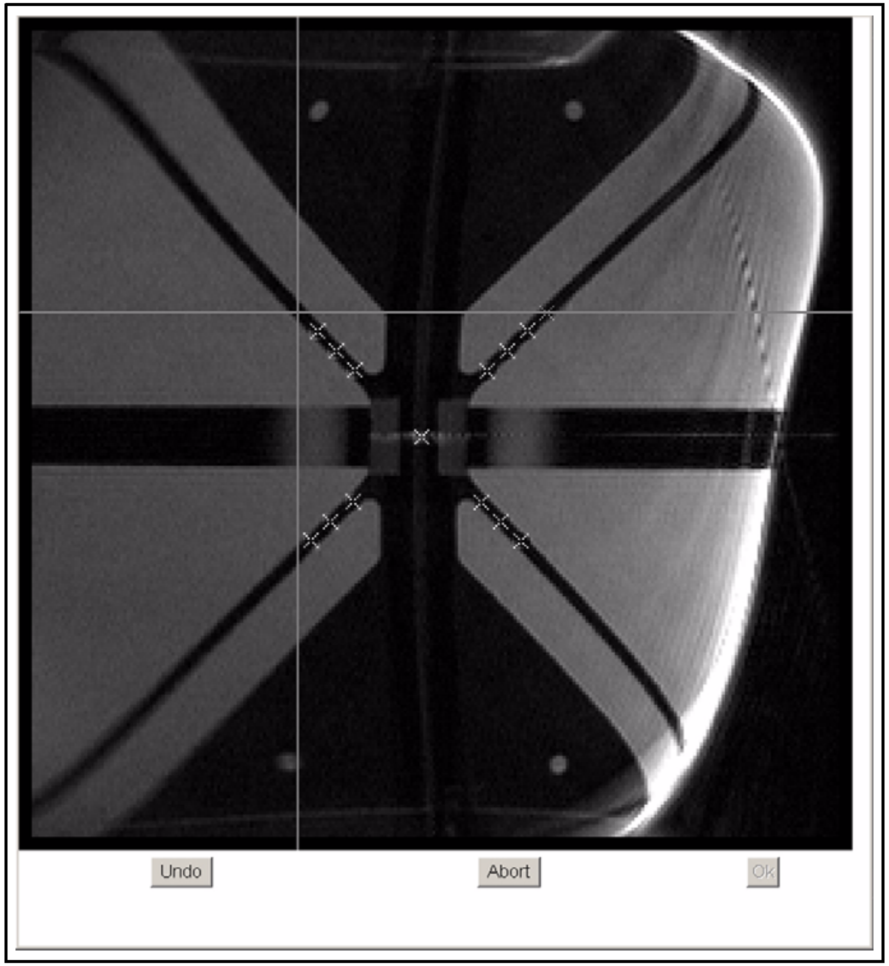
- When all the X prompts are correctly aligned click on the OK button and repeat the procedure centering and aligning the X prompt on the diagonal axis of the Sagittal image

Fig. 283: Sagittal image with center and X prompt aligned



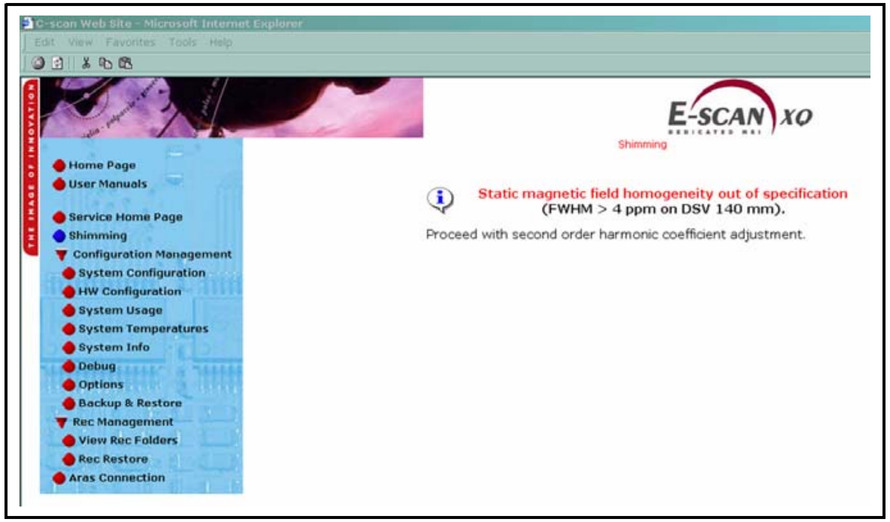
- When all the X prompts are correctly aligned click on the OK button and repeat the procedure centering and aligning the X prompt on the diagonal axis of the Coronal image, otherwise click on the Undo button and repeat the alignment

Fig. 284: Coronal image with center and X prompt aligned



- When all the X prompts are correctly aligned click on the OK button and the System will compute the shimming calculation telling you if it's necessary or not proceed with the parameters correction, otherwise click on the Undo button and repeat the alignment. If the parameters are correct the procedure is finished and you have to fill in the **Installation Quality Form** with the saved values

Fig. 285: Shimming Parameters out of specification



Static magnetic field homogeneity out of specification
(FWHM > 4 ppm on DSV 140 mm).

Proceed with second order harmonic coefficient adjustment.

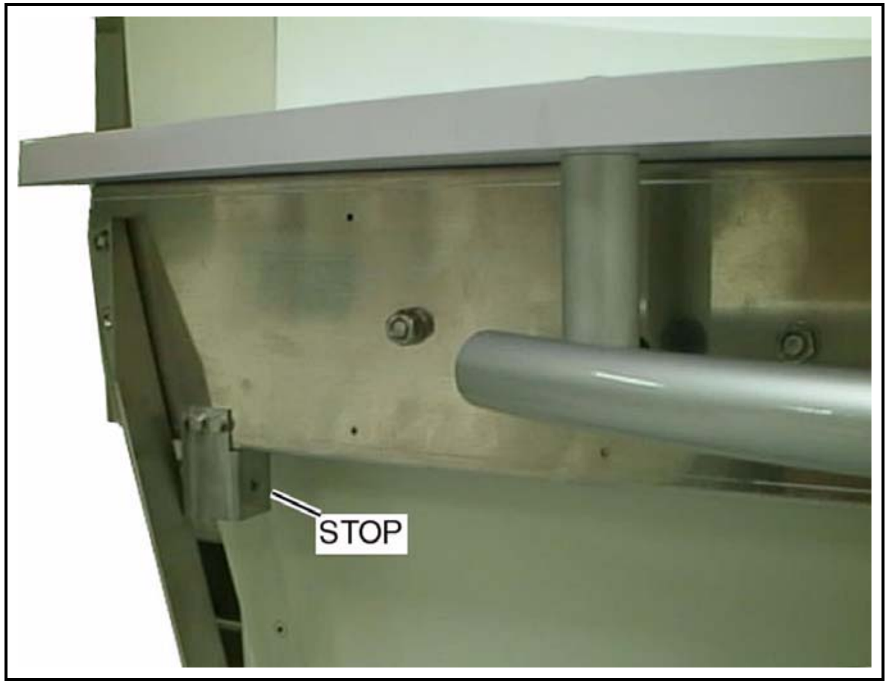
- If the parameters are not correct disable the SGRA module switching off the Electronic Unit, how to open the magnet and remove the shimming plates is described below

NOTICE	The shimming parameter values and the accepted solution are visible clicking on the button **Shim History** on the Shimming IE page

Access to the shimming plates

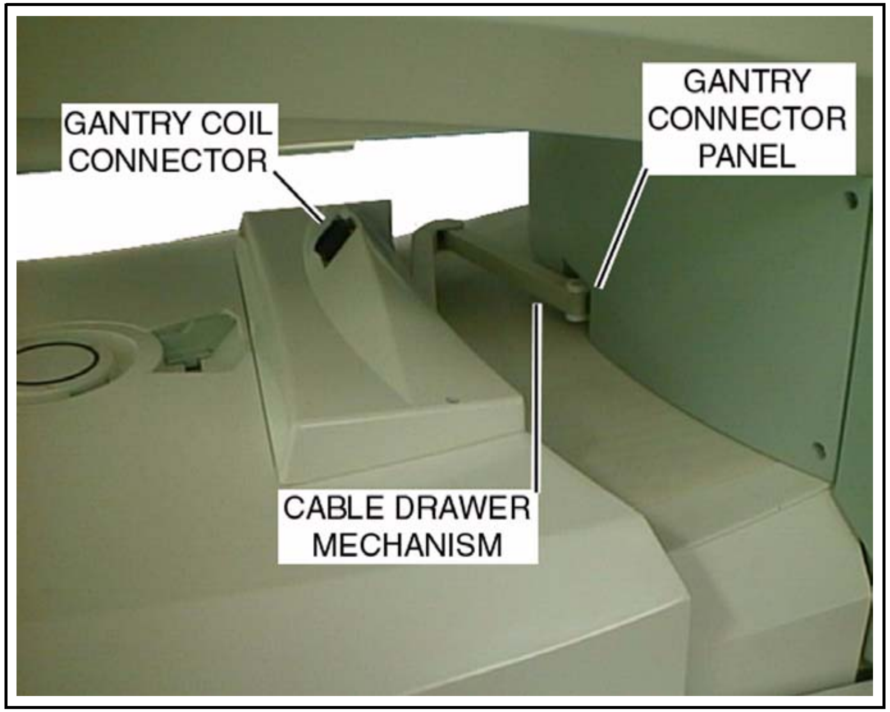
- Remove the two lower side covers of the patient bed. Screws are fitted along the covers to fix them to the other covers and on the top to fix them to the round table of the patient bed
- Remove the horizontal bar unscrewing the bolts on each side used to fix the horizontal bar to the vertical bars
- To take completely out the patient bed, you must first remove the two patient bed stops (one per side) placed on the magnet brackets and fixed by two bolts, as shown in the following figure.

Fig. 286: Magnet brackets stop



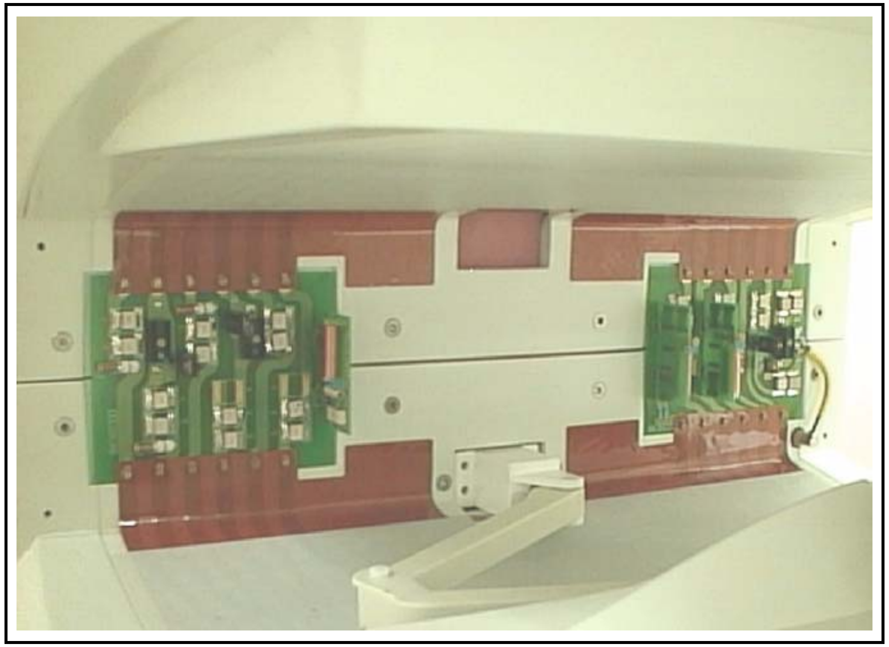
- Disconnect the receiving cable drawer and slide out the patient table completely

Fig. 287: Receiving cable drawer



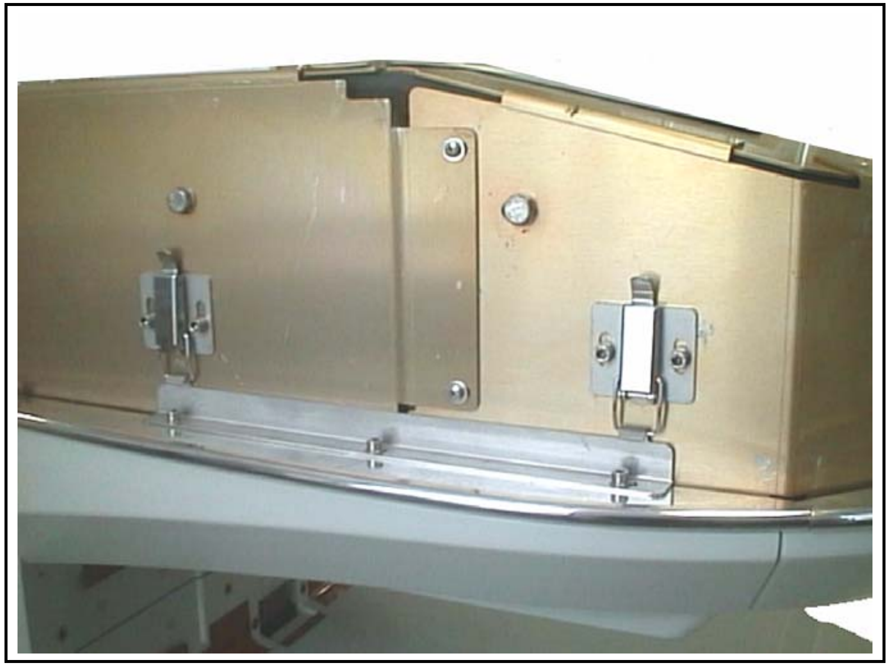
- Remove the receiving cables panel

Fig. 288: Transmitting circuits and coil



- Remove the transmitting circuits (matching and tuning shown in the previous figure)
- Remove the upper screws (four metallic and four plastic) from the upper gantry cover
- Before starting to disassemble the gantry insert something in the magnet to stop the gantry from breaking. As written before, the gantry is composed of two covers and they are assembled together using aluminum plates
- The gantry is fixed to the magnet structure by screws along the upper and lower metallic profiles as shown in the following two figures

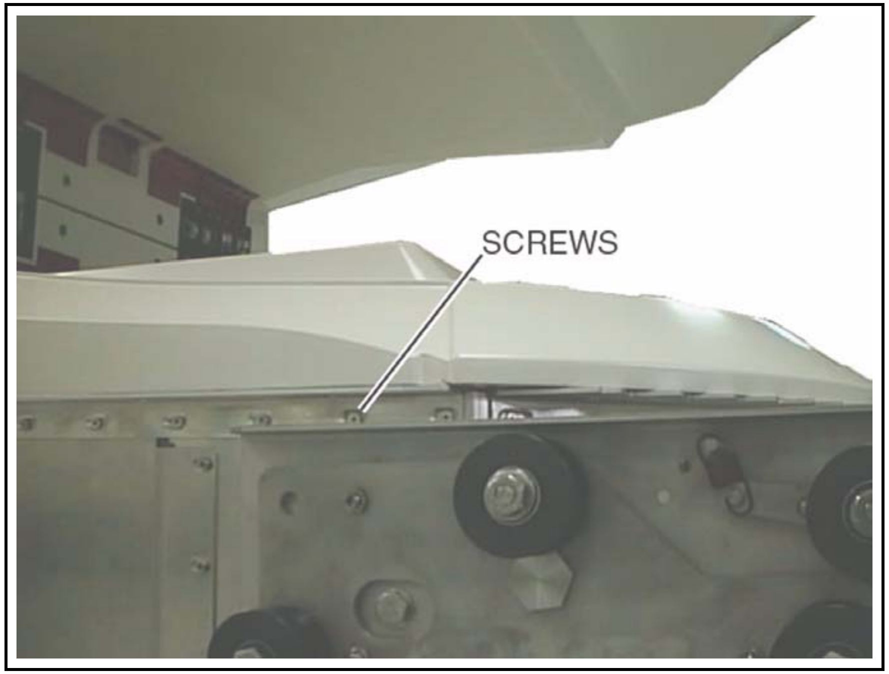
Fig. 289: Insert a box into the magnet to avoid gantry breaking



NOTICE	The new Magnets have clips instead of screws to fix the Gantry and only four screws on the front side

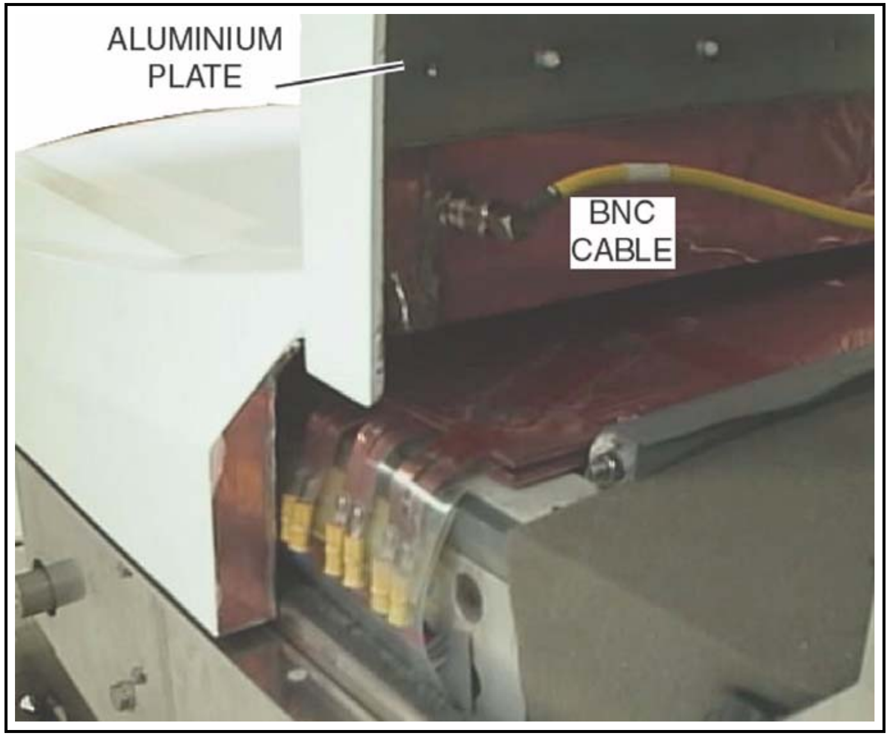
- Using a Philips screwdriver, remove the screws that fix the metallic upper profile to the magnet to remove the upper gantry cover

Fig. 290: Lower metallic profile with screws



- In the lower side using a Philips screwdriver, remove the screws that fix the metallic lower profile to the magnet structure and leave the lower metallic profile fixed to the gantry
- Before removing the lower gantry cover disconnect the BNC cable connected on the back of the gantry as shown in the next figure

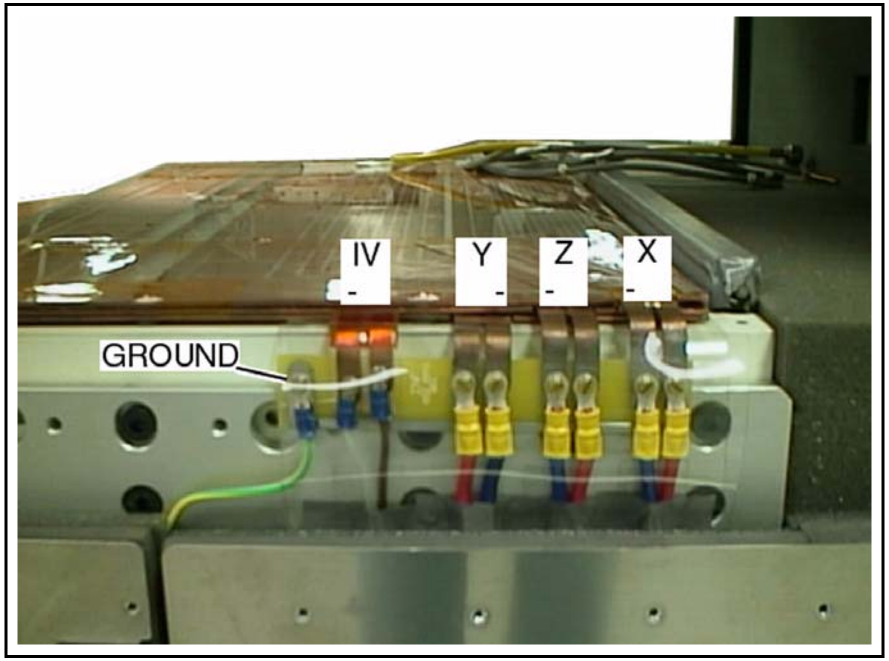
Fig. 291: Gantry BNC cable and aluminum plate (rear view)



Now you can disconnect the upper and lower gradient cables and

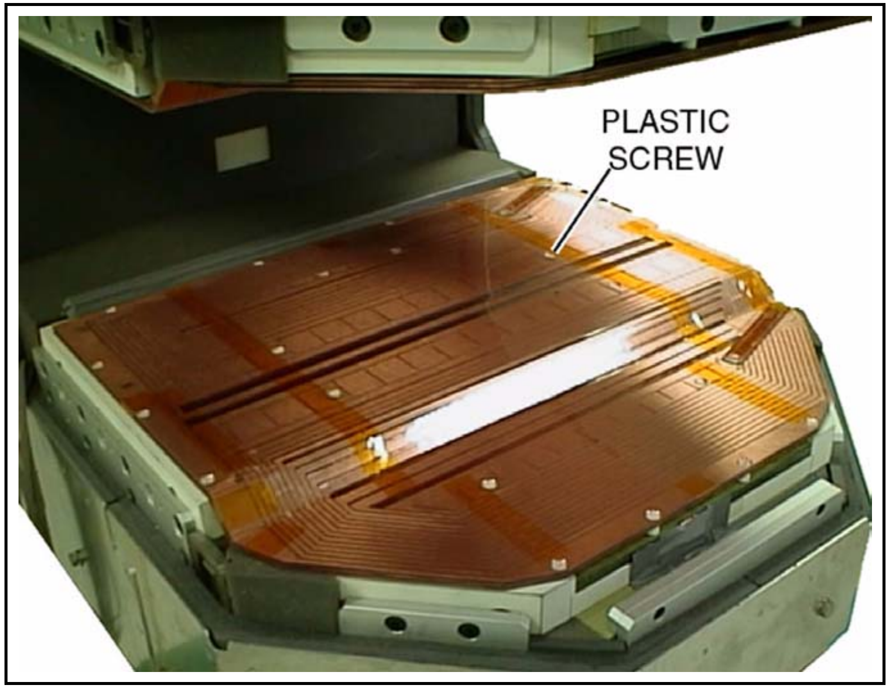
⚠**WARNING** **The SGRA must be disabled before disconnecting the gradient cables (switching off the Electronic Unit)**

Fig. 292: Lower gradient coil connections



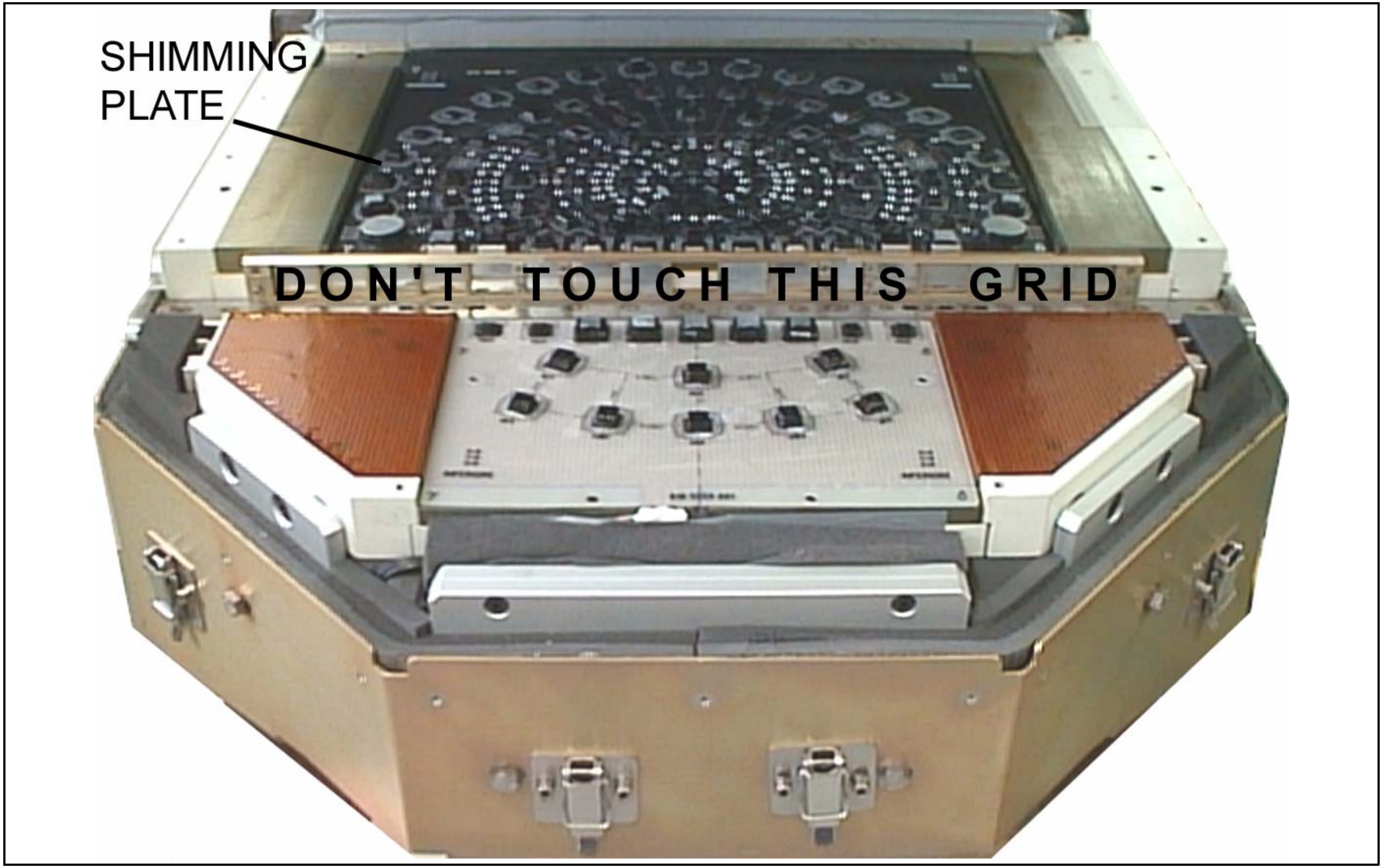
- Remove the gradient coils by unscrewing the plastic screws
- When the gradient coil (upper and lower) are removed the plastic shimming plates are visible: remove them and go ahead with the procedure

Fig. 293: Lower gradient coil



⚠**WARNING** **Don't remove any other hardware after removing the Gradient Coils. Removing any other hardware may cause the permanent shims to come loose from their position and ruin the magnet shimming and image quality permanently!**

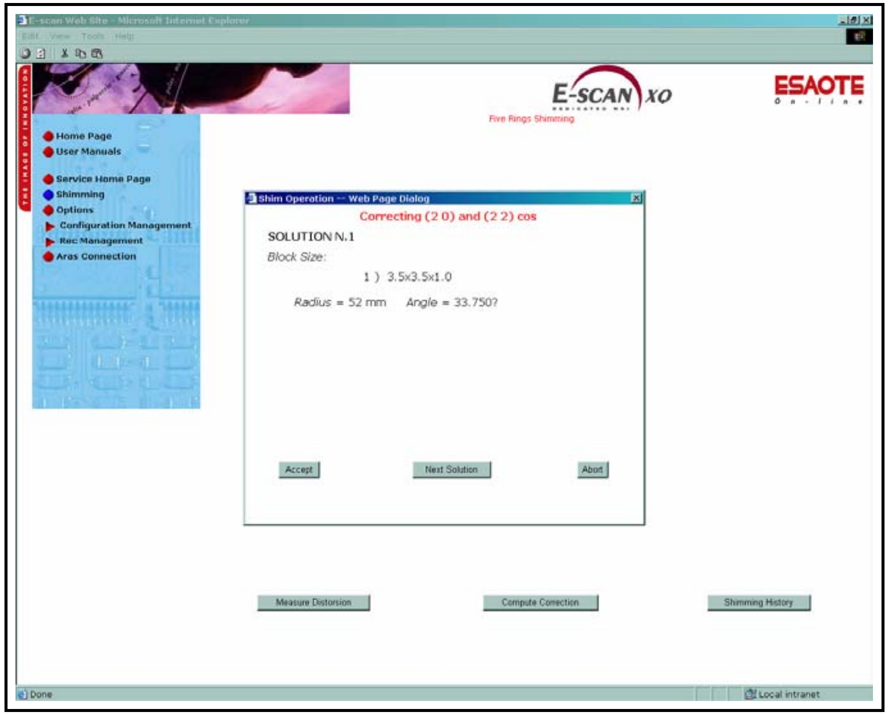
Fig. 294: Lower Carbon Fiber Shimming Plate



Shimming parameters correction

- From Explorer, Shimming page, press the **Compute** button and the system will give you the easiest of many possible solutions
- Check if the suggested position on the shimming plate is empty or not: if it's empty select **<YES>**; otherwise select **<NO>**

Fig. 295: Suggested solution



Correcting (2 0) and (2 2) cos

SOLUTION N.1

Block Size:

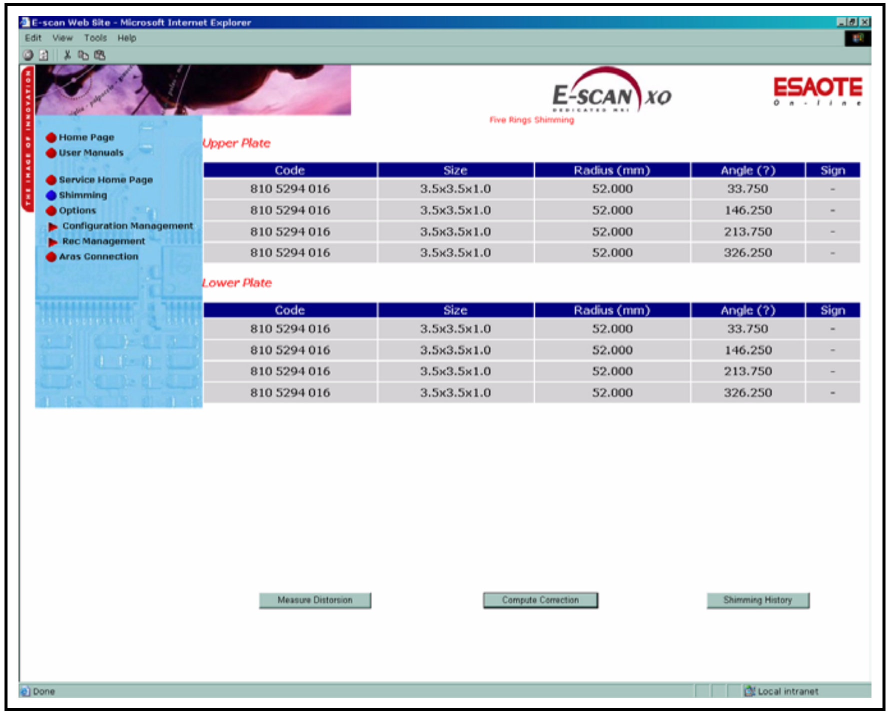
1) 3.5x3.5x1.0

Radius = 52 mm *Angle* = 33.750?

NOTICE	You only need to check one position because the neodymium pieces are glued on symmetrical positions

- If you type **<YES>** the system will show you or the solution to correct another wrong parameter or all the positions that compound the accepted solution

Fig. 296: Use the scroll bar to display also the Lower plate



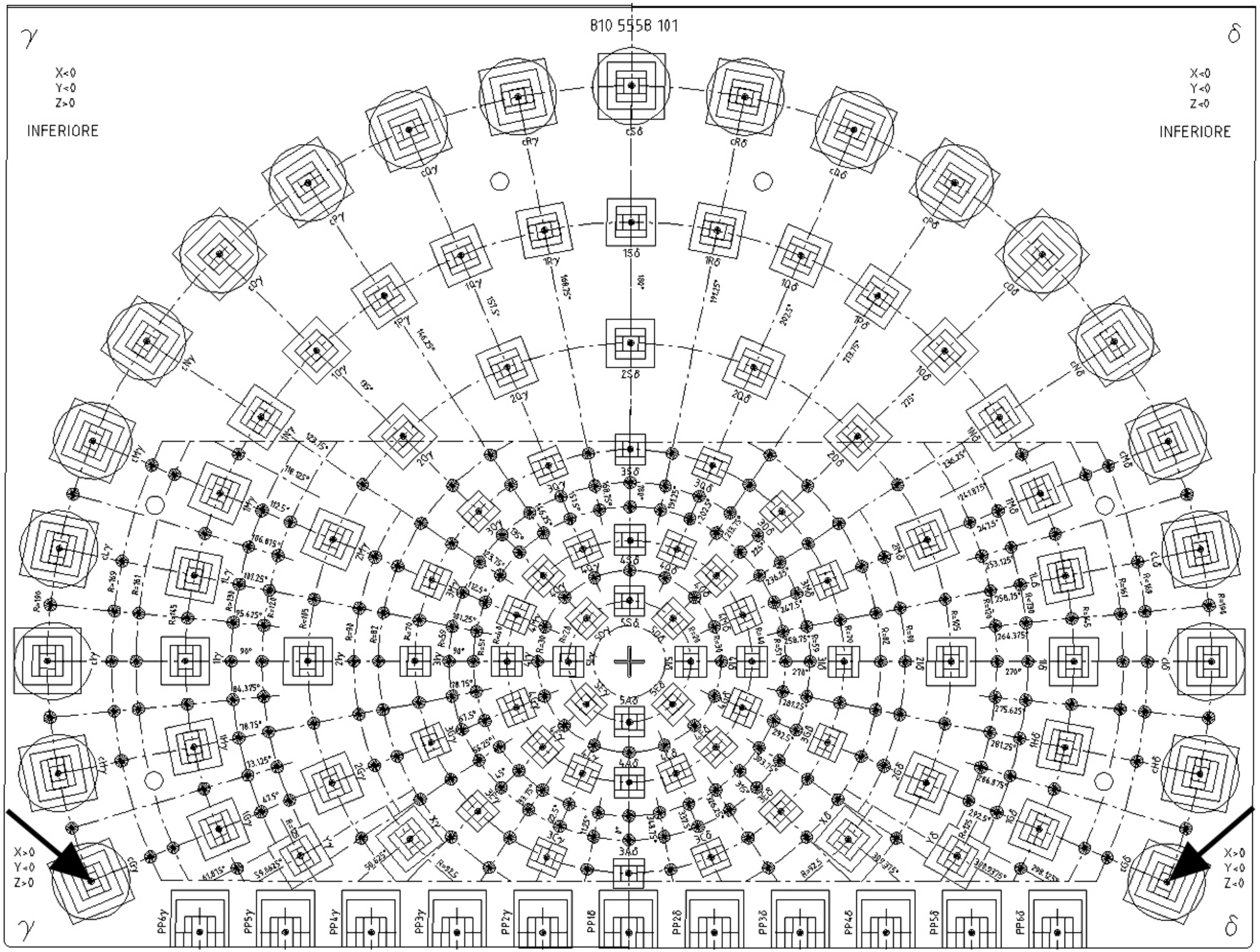
Upper Plate

Code	Size	Radius (mm)	Angle (?)	Sign
810 5294 016	3.5x3.5x1.0	52.000	33.750	-
810 5294 016	3.5x3.5x1.0	52.000	146.250	-
810 5294 016	3.5x3.5x1.0	52.000	213.750	-
810 5294 016	3.5x3.5x1.0	52.000	326.250	-

Lower Plate

Code	Size	Radius (mm)	Angle (?)	Sign
810 5294 016	3.5x3.5x1.0	52.000	33.750	-
810 5294 016	3.5x3.5x1.0	52.000	146.250	-
810 5294 016	3.5x3.5x1.0	52.000	213.750	-
810 5294 016	3.5x3.5x1.0	52.000	326.250	-

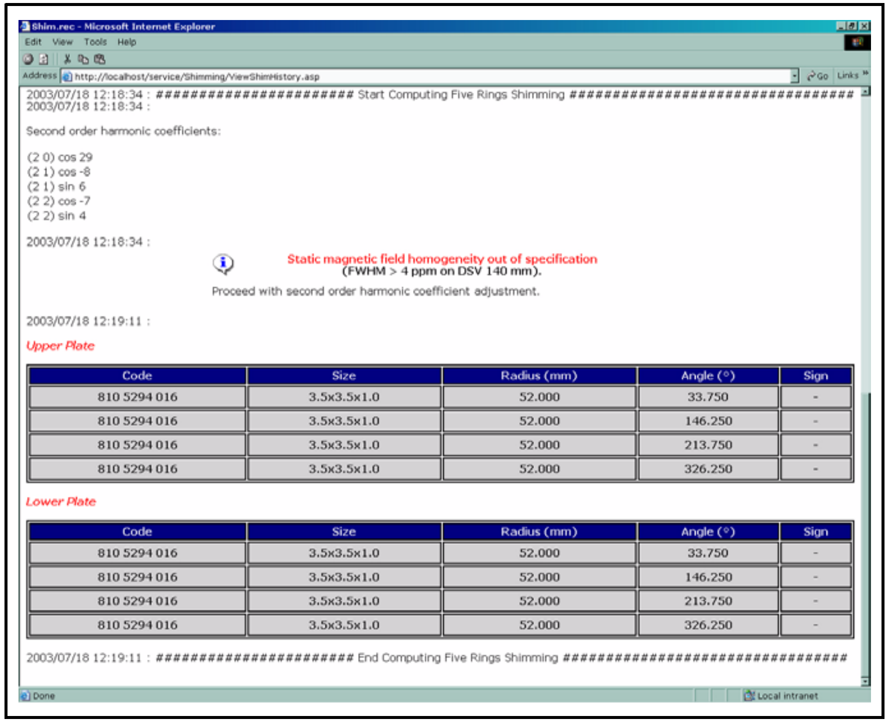
Fig. 297: Shimming plate and reference neodymium coins (always-positive polarity!)



NOTICE	In case of two or more out of spec shimming pa-rameters, the software suggests solutions for each parameter: if the solutions use the same positions the system will show the final values taking care of the different pieces suggested

- Take notes of the positions and select **<Quit>**. If you need to read the solution again press the **Shim History** button of the Shimming page

Fig. 298: Shimming History Table


Shim.rec - Microsoft Internet Explorer
Edit View Tools Help
Address
http://localhost/service/Shimming/ViewShimHistory.asp
Go
Links
Done
Local intranet

```
2003/07/18 12:18:34 : ####################### Start Computing Five Rings Shimming ###################################
2003/07/18 12:18:34 :

Second order harmonic coefficients:

(2 0) cos 29
(2 1) cos -8
(2 1) sin 6
(2 2) cos -7
(2 2) sin 4

2003/07/18 12:18:34 :
```

Static magnetic field homogeneity out of specification
(FWHM > 4 ppm on DSV 140 mm).

Proceed with second order harmonic coefficient adjustment.

```
2003/07/18 12:19:11 :
```

Upper Plate

Code	Size	Radius (mm)	Angle (°)	Sign
810 5294 016	3.5x3.5x1.0	52.000	33.750	-
810 5294 016	3.5x3.5x1.0	52.000	146.250	-
810 5294 016	3.5x3.5x1.0	52.000	213.750	-
810 5294 016	3.5x3.5x1.0	52.000	326.250	-

Lower Plate

Code	Size	Radius (mm)	Angle (°)	Sign
810 5294 016	3.5x3.5x1.0	52.000	33.750	-
810 5294 016	3.5x3.5x1.0	52.000	146.250	-
810 5294 016	3.5x3.5x1.0	52.000	213.750	-
810 5294 016	3.5x3.5x1.0	52.000	326.250	-

```
2003/07/18 12:19:11 : ####################### End Computing Five Rings Shimming ###################################
```

- Now place the neodymium pieces on the shimming plates making sure their positions, dimensions and polarity comply with the software indications. Regarding polarity, use the two pieces indicated by arrows in the previous figure of the shimming plate as a reference: their polarity is always positive in every magnet. Use double-sided tape and paper tape to fix the pieces, do not use glue for the moment

NOTICE	Positive for the upper shimming plate means negative for the lower shimming plate!!!

- Re-place the shimming plates into the magnet and re-place all the parts that make up the magnet (gantry and patient bed) and re-connect all the cables following the procedures before explained and enable the SGRA module re-connecting the Power cable (rear side)
- Repeat the shimming parameters procedure from the beginning
  - If the parameters are now correct fix the neodymium pieces with glue using this procedure to have access to the shimming plates
  - If the parameters are not correct remove the shimming plates and check the polarity and position of the shimming material placed on the plates to correct the wrong parameters. If every-thing is correct proceed with another shimming parameter correction using this procedure

NOTICE	When making shimming adjustments repeat the System calibration from the Frequency Calibration on skipping the Shimming Check of course

Coil Tuning Adjustment

Introduction

Varicap calibration is performed for tuning the receiving coils. Every coil has a different varicap value. For every coil two coil tuning checks must be performed: automatic and manual.

Only the Shoulder Coils has only one varicap, the other coils have two varicaps.

The algorithm used by the automatic calibration procedure (Coil Tuning) is very simple and consists of changing the value of the command corresponding to the varicap voltage while observing the MR signal being picked up. The calibration program considers that the tuned condition is reached when the maximum acquired signal is obtained.

The fact that a given varicap voltage value corresponds to each coil avoids lengthy calibration sessions. The program starts at this value to search for the maximum signal condition. The comparison with the default values (refer to the installation protocol) may indicate any changes in the tuning of the coil being examined.

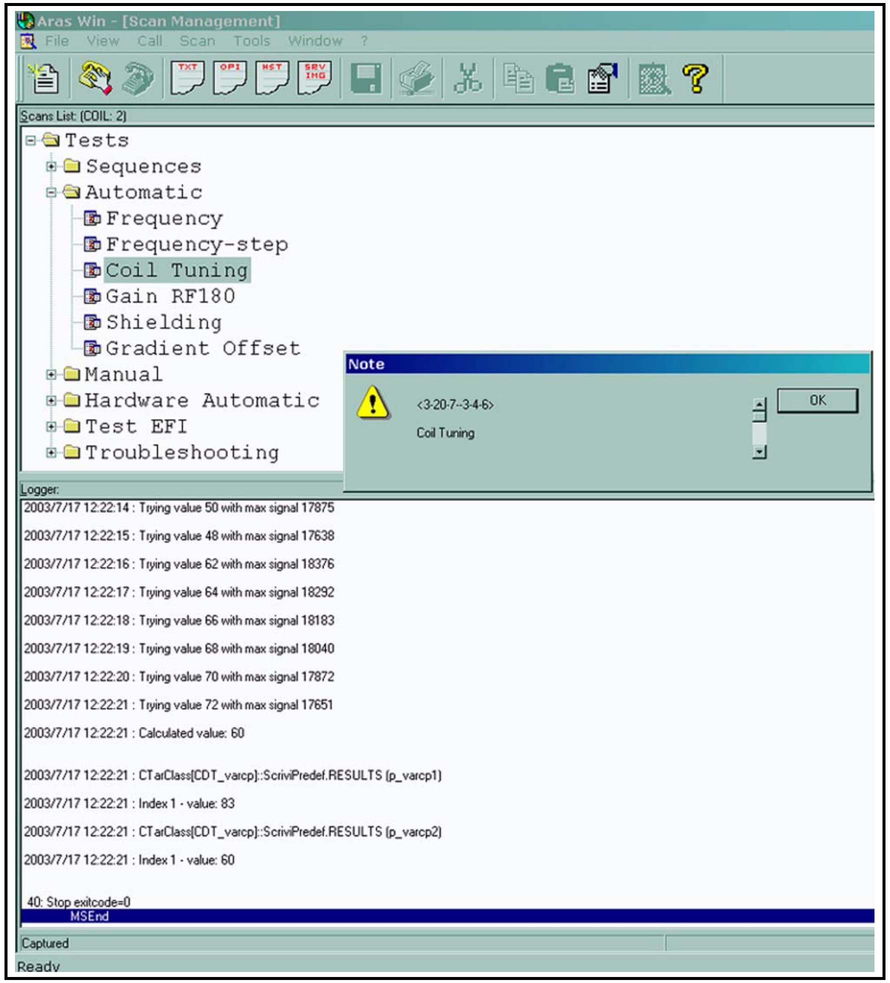
Necessary Tools:

- Big Spherical Phantom and its support
- Small Homogeneous Phantom and its support

Automatic Operation

- Put the coil with the suitable phantom and perform a Scout selecting the district <Other> and <A> bed patient and <A> bed patient
- Under ARAS select **<Tests> <Automatic> <Coil Tuning>** then **<Exec>**

Fig. 299: Automatic procedure



<3-20-7--3-4-6>

Coil Tuning

```
2003/7/17 12:22:14 : Trying value 50 with max signal 17875
2003/7/17 12:22:15 : Trying value 48 with max signal 17638
2003/7/17 12:22:16 : Trying value 62 with max signal 18376
2003/7/17 12:22:17 : Trying value 64 with max signal 18292
2003/7/17 12:22:18 : Trying value 66 with max signal 18183
2003/7/17 12:22:19 : Trying value 68 with max signal 18040
2003/7/17 12:22:20 : Trying value 70 with max signal 17872
2003/7/17 12:22:21 : Trying value 72 with max signal 17651
2003/7/17 12:22:21 : Calculated value: 60

2003/7/17 12:22:21 : CTarClass[CDT_varcp]::ScriviPredef.RESULTS (p_varcp1)
2003/7/17 12:22:21 : Index 1 - value: 83
2003/7/17 12:22:21 : CTarClass[CDT_varcp]::ScriviPredef.RESULTS (p_varcp2)
2003/7/17 12:22:21 : Index 1 - value: 60

 40: Stop exitcode=0
       MSEnd
```

- Look at the message sent by the calibration procedure and re-peat the test two or three times checking if the varicap value is always the same or different by just a few units

- Enter in the manual test and save the average value between the found values
- If the values are correct, fill in the Installation Quality Form with the saved value
- Repeat all the operations for the others coils

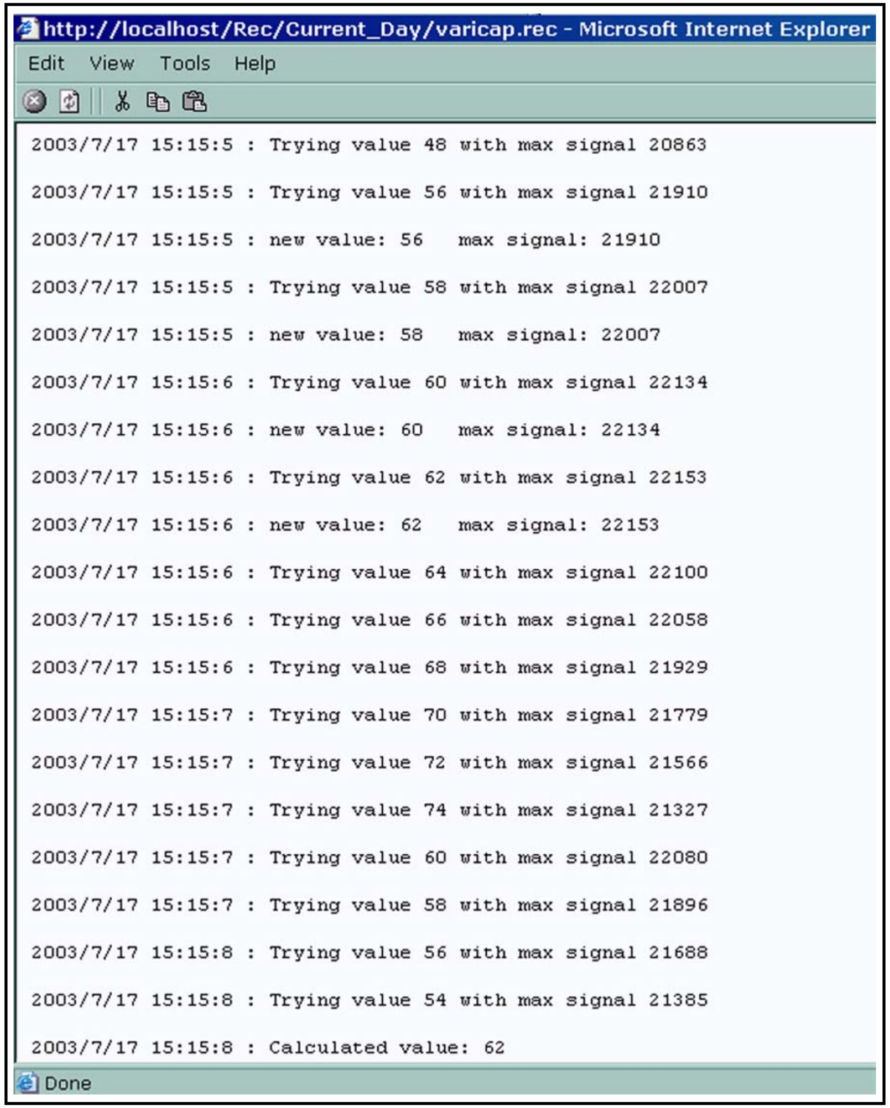
If this was not successful, do not continue, but rather check the **“varicap.rec”** store file, use the scroll bar to reach the end of the file.

The calibration program sends some information relating to its compilation date, etc., the list of values of the varicap command that are being tested and their results in terms of signal level to “varicap.rec”. Before ending, the program specifies the calculated varicap value and writes it to the “.predef” temporary file.

Since varicap calibration requires the acquired signal to be viewed, it must be preceded by calibration of the receiving chain gain, in order to shift the signal to a visible area (about in the middle of the range). Abnormal gain values may indicate quantity problems in the picked up signal; in any case, these will be made apparent in sub-sequent acquisitions.

NOTICE During calibration the Shoulder Coil 1 must be rotated 30° with respect to the Z gradient direc-tion while The Shoulder Coil 5 must be placed in Sagittal position (along the Z axis)

Fig. 300: Varicap Rec File


http://localhost/Rec/Current_Day/varicap.rec - Microsoft Internet Explorer
Edit
View
Tools
Help
Done

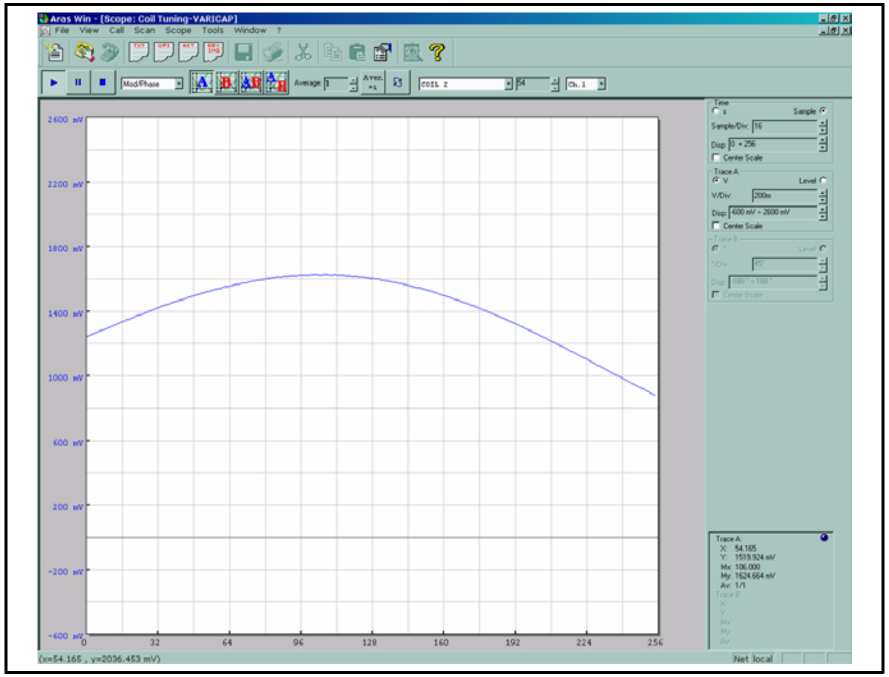
```
2003/7/17 15:15:5 : Trying value 48 with max signal 20863

2003/7/17 15:15:5 : Trying value 56 with max signal 21910

2003/7/17 15:15:5 : new value: 56   max signal: 21910

2003/7/17 15:15:5 : Trying value 58 with max signal 22007

2003/7/17 15:15:5 : new value: 58   max signal: 22007

2003/7/17 15:15:6 : Trying value 60 with max signal 22134

2003/7/17 15:15:6 : new value: 60   max signal: 22134

2003/7/17 15:15:6 : Trying value 62 with max signal 22153

2003/7/17 15:15:6 : new value: 62   max signal: 22153

2003/7/17 15:15:6 : Trying value 64 with max signal 22100

2003/7/17 15:15:6 : Trying value 66 with max signal 22058

2003/7/17 15:15:6 : Trying value 68 with max signal 21929

2003/7/17 15:15:7 : Trying value 70 with max signal 21779

2003/7/17 15:15:7 : Trying value 72 with max signal 21566

2003/7/17 15:15:7 : Trying value 74 with max signal 21327

2003/7/17 15:15:7 : Trying value 60 with max signal 22080

2003/7/17 15:15:7 : Trying value 58 with max signal 21896

2003/7/17 15:15:8 : Trying value 56 with max signal 21688

2003/7/17 15:15:8 : Trying value 54 with max signal 21385

2003/7/17 15:15:8 : Calculated value: 62
```

Manual Operation

During manual calibration, the echo signal is displayed. By adjusting the **<Channel 1>**, and **<Channel 2>** for the DPA coils, variable with the arrows, it is possible to change the varicap command value. When seen in the **<Module>** visualization mode, this value must decrease when moving further from the default value as found by the automatic calibration procedure

- Position the coil with the suitable phantom (refer to the Quality Form) into the magnet and perform a scout selecting the district <Other> and <A> bed patient
- Under ARAS select **<Tests> <Manual> <Coil Tuning>** then **<Exec>**

Fig. 301: Varicap1 not Maximized

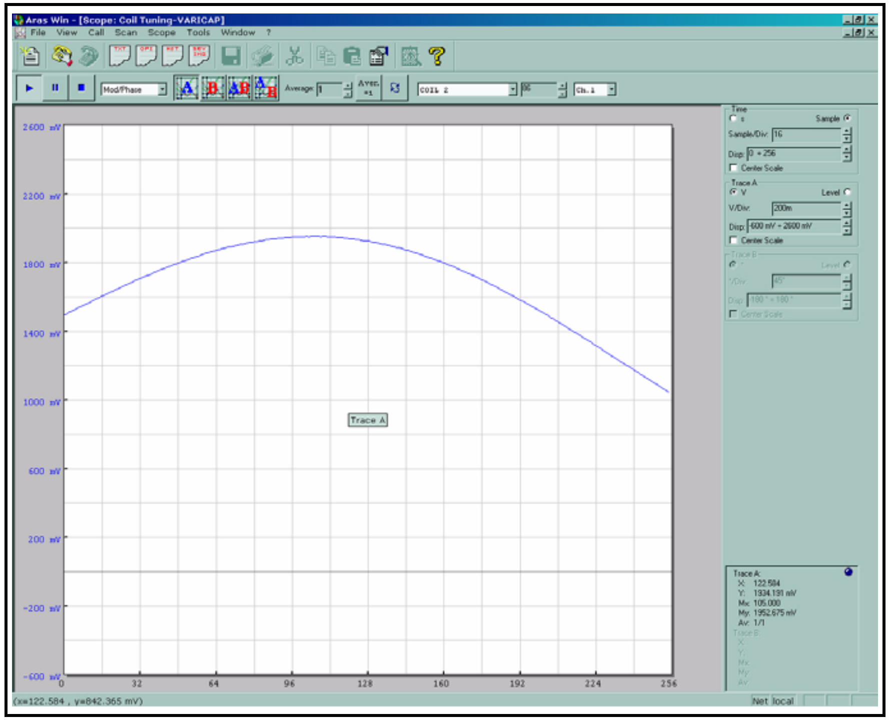


Trace A:
X: 54.165
Y: 1519.924 mV
Mx: 106.000
My: 1624.664 mV
Av: 1/1

(x=54.165 , y=2036.453 mV)

- Adjust the **<Gain 1>** to bring the signal to about 20 K (inside the monitor leaving the default visualization settings) as shown in the previous figure
- Select the Coil (automatically recognized) and then select the **Channel 1** (that corresponds to the **VARICAP1**) and change its value to maximize the signal without taking care of its position

Fig. 302: Maximized Varicap1

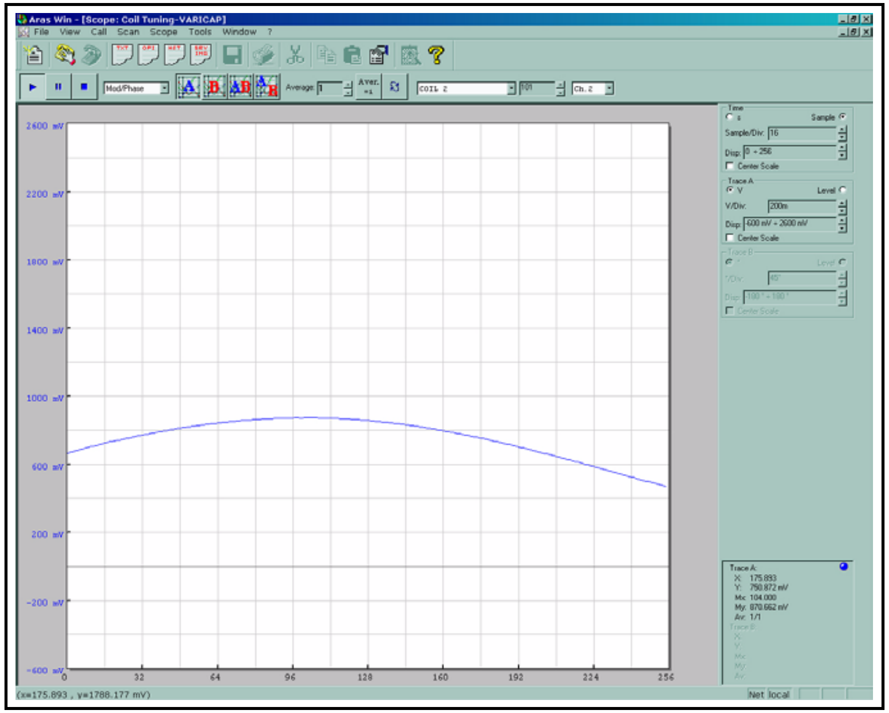


Trace A:
X: 122.584
Y: 1934.191 mV
Mx: 105.000
My: 1952.675 mV
Av: 1/1

(x=122.584 , y=842.365 mV)

- If you are adjusting a Linear Coil skip this point otherwise change the **Channel (from 1 to 2)** and repeat this calibration for the **VARICAP 2**

Fig. 303: Varicap2 not Maximized:

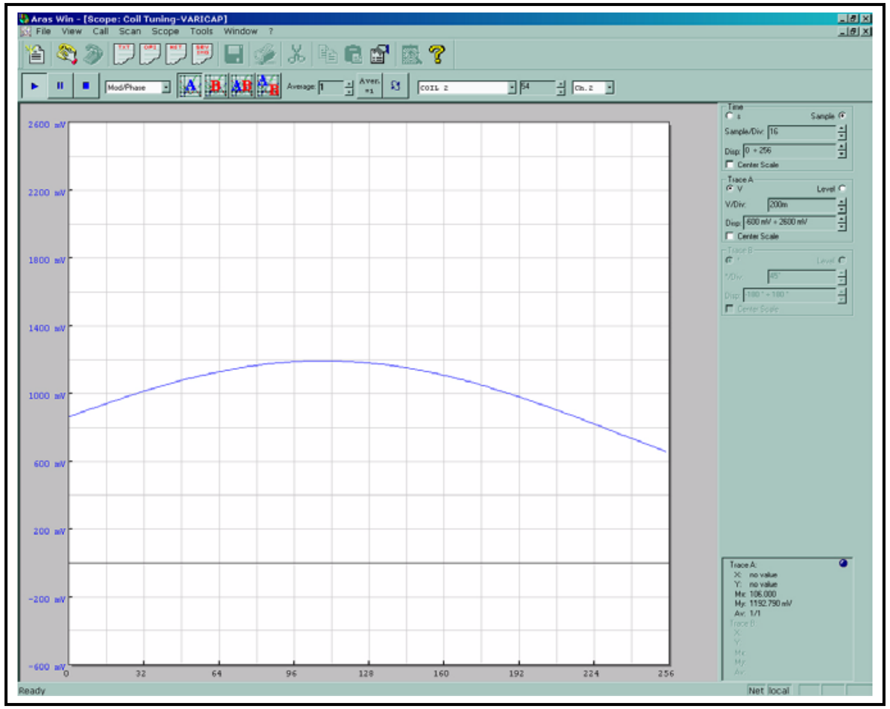


Sample/Div: 16
Disp: 0 ÷ 256
V/Div: 200m
Disp: 600 mV ÷ 2600 mV

Trace A:
X: 175.893
Y: 750.872 mV
Mx: 104.000
My: 870.662 mV
Av: 1/1

(x=175.893 , y=1788.177 mV)

Fig. 304: Maximized Varicap2



Sample/Div: 16
Disp: 0 ÷ 256
V/Div: 200m
Disp: 600 mV ÷ 2600 mV

Trace A:
X: no value
Y: no value
Mx: 106.000
My: 1192.790 mV
Av: 1/1

- Save the best values found and repeat all the operations for the other coils from the beginning (specially the scout!!!) and re-member that dual phased array coils have two varicaps
- If the values are correct, fill in the **Installation Quality Form** with the saved value

RF 180° pulse gain calibration

Introduction

This paragraph provides a detailed description of how to tune the 180° pulse for each coil. Tuning of the other pulse types will be automatic, based on the value found for the 180°-pulse. In this case too, it is clear that, if, for any reason whatsoever, tuning of the 180°-pulse is unsuccessful, tuning of the other pulses will be incorrect also. The 180°-pulse calibration is performed to adjust for the energy transferred to the spins by this RF pulse. Every coil has a different 180°-pulse value.

The algorithm used is very simple and consists of changing the transmission gain value corresponding to 180° and observing the MR signal picked up. The calibration program considers that the tuned condition is reached when the maximum acquired signal is obtained. Since it requires the acquired signal to be viewed, the 180° calibration must be preceded by calibration of the receiving chain gain to shift the signal to an area around the middle of the range. Abnormal gain values may indicate quantity problems in the signal being picked up.

Necessary Tools

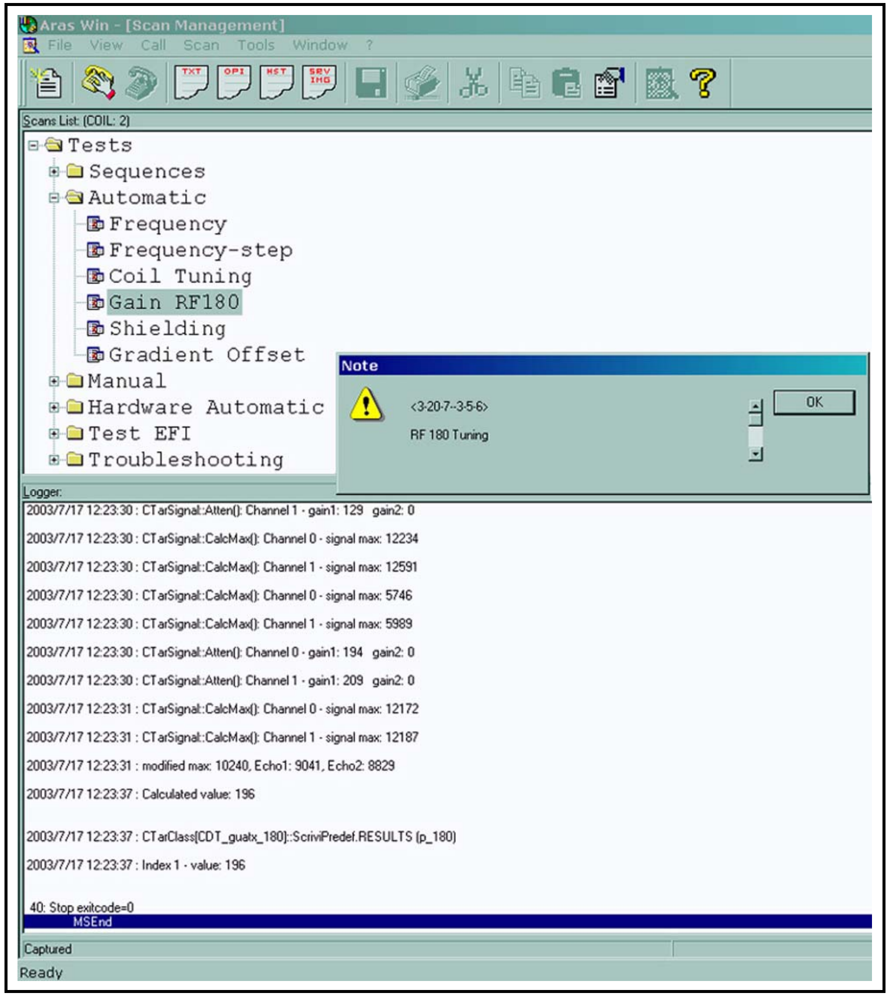
– Big Spherical Phantom and its support

– Small Homogeneous Phantom and its support

Automatic Operations

- Put the coil with the suitable phantom into the magnet and per-form a Scout selecting the district **<Other>** and **<A>** bed patient
- Under ARAS select **<Tests> <Automatic> < RF 180 Gain>**, then **<Exec>**

Fig. 305: Automatic 180° Pulse Calibration



<3-20-7--3-5-6>
RF 180 Tuning

```
2003/7/17 12:23:30 : CTarSignal:Atten(): Channel 1 - gain1: 129   gain2: 0
2003/7/17 12:23:30 : CTarSignal:CalcMax(): Channel 0 - signal max: 12234
2003/7/17 12:23:30 : CTarSignal:CalcMax(): Channel 1 - signal max: 12591
2003/7/17 12:23:30 : CTarSignal:CalcMax(): Channel 0 - signal max: 5746
2003/7/17 12:23:30 : CTarSignal:CalcMax(): Channel 1 - signal max: 5989
2003/7/17 12:23:30 : CTarSignal:Atten(): Channel 0 - gain1: 194   gain2: 0
2003/7/17 12:23:30 : CTarSignal:Atten(): Channel 1 - gain1: 209   gain2: 0
2003/7/17 12:23:31 : CTarSignal:CalcMax(): Channel 0 - signal max: 12172
2003/7/17 12:23:31 : CTarSignal:CalcMax(): Channel 1 - signal max: 12187
2003/7/17 12:23:31 : modified max: 10240, Echo1: 9041, Echo2: 8829
2003/7/17 12:23:37 : Calculated value: 196

2003/7/17 12:23:37 : CTarClass[CDT_guatx_180]::ScriviPredef.RESULTS (p_180)
2003/7/17 12:23:37 : Index 1 - value: 196

 40: Stop exitcode=0
```

- Look at the message sent by the calibration procedure and re-peat the test two or three times checking if the 180°-pulse value is always the same or different by just few units
- Enter in the manual test and save the last found value

- If the values are correct, fill in the **Installation Quality Form** with the saved value
- Repeat all the operations for the other coils

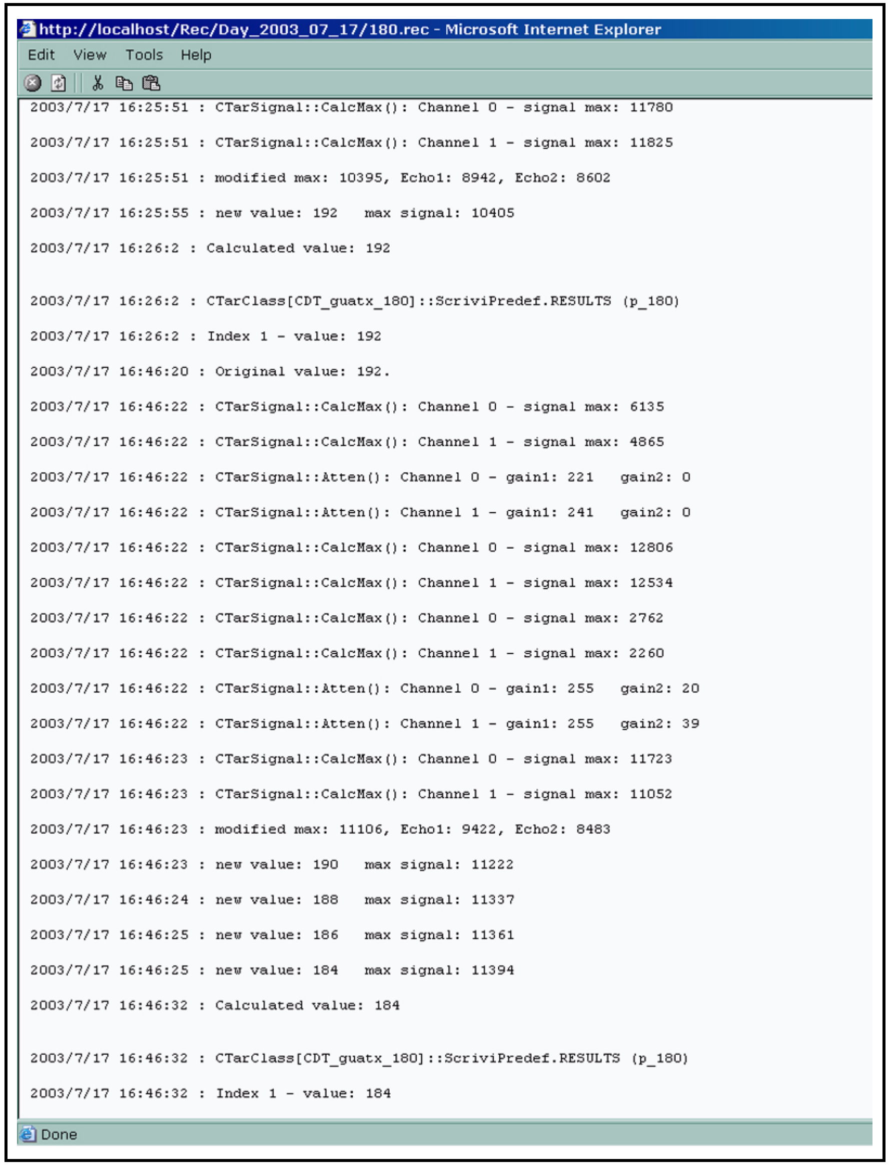
The automatic program sends some information relating to its date of compilation etc., the list of the 180° transmission gain values attempted and the relating results in terms of signal level to the 180.rec file.

If this was not successful, do not continue, but rather check the store file **180.rec**. Use the scroll bar to reach the end of the file and record the 180°-pulse value found.

NOTICE	During calibration the shoulder coil 1 must be rotated 30° with respect to the Z gradient direction

NOTICE	The Shoulder Coil 5 must be placed in sagittal position (along the Z axis)

Fig. 306: 180° Pulse Rec File

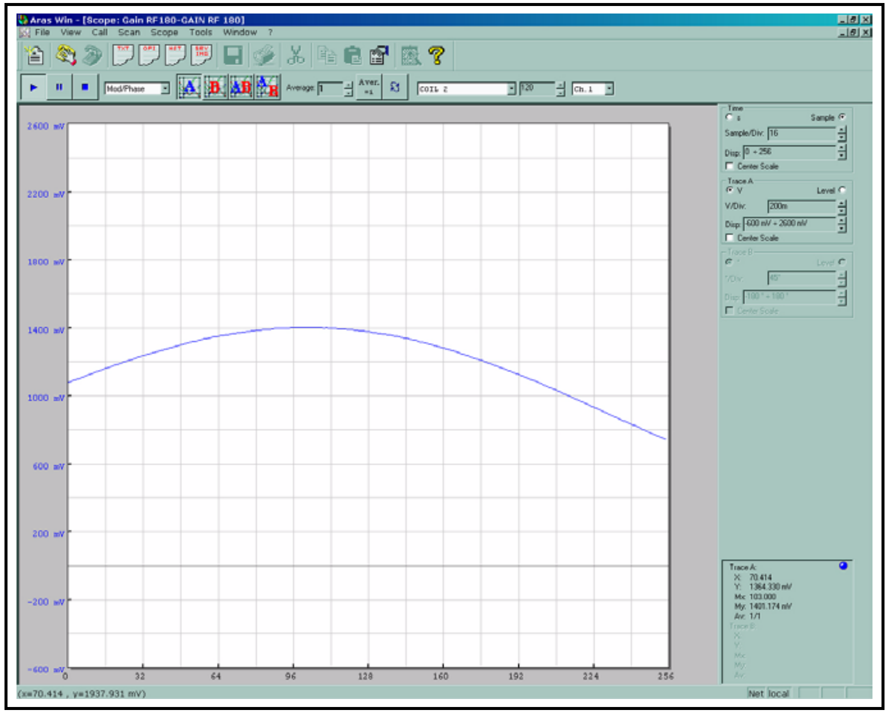

http://localhost/Rec/Day_2003_07_17/180.rec - Microsoft Internet Explorer
Edit View Tools Help

```
2003/7/17 16:25:51 : CTarSignal::CalcMax(): Channel 0 - signal max: 11780
2003/7/17 16:25:51 : CTarSignal::CalcMax(): Channel 1 - signal max: 11825
2003/7/17 16:25:51 : modified max: 10395, Echo1: 8942, Echo2: 8602
2003/7/17 16:25:55 : new value: 192   max signal: 10405
2003/7/17 16:26:2 : Calculated value: 192

2003/7/17 16:26:2 : CTarClass[CDT_guatx_180]::ScriviPredef.RESULTS (p_180)
2003/7/17 16:26:2 : Index 1 - value: 192
2003/7/17 16:46:20 : Original value: 192.
2003/7/17 16:46:22 : CTarSignal::CalcMax(): Channel 0 - signal max: 6135
2003/7/17 16:46:22 : CTarSignal::CalcMax(): Channel 1 - signal max: 4865
2003/7/17 16:46:22 : CTarSignal::Atten(): Channel 0 - gain1: 221   gain2: 0
2003/7/17 16:46:22 : CTarSignal::Atten(): Channel 1 - gain1: 241   gain2: 0
2003/7/17 16:46:22 : CTarSignal::CalcMax(): Channel 0 - signal max: 12806
2003/7/17 16:46:22 : CTarSignal::CalcMax(): Channel 1 - signal max: 12534
2003/7/17 16:46:22 : CTarSignal::CalcMax(): Channel 0 - signal max: 2762
2003/7/17 16:46:22 : CTarSignal::CalcMax(): Channel 1 - signal max: 2260
2003/7/17 16:46:22 : CTarSignal::Atten(): Channel 0 - gain1: 255   gain2: 20
2003/7/17 16:46:22 : CTarSignal::Atten(): Channel 1 - gain1: 255   gain2: 39
2003/7/17 16:46:23 : CTarSignal::CalcMax(): Channel 0 - signal max: 11723
2003/7/17 16:46:23 : CTarSignal::CalcMax(): Channel 1 - signal max: 11052
2003/7/17 16:46:23 : modified max: 11106, Echo1: 9422, Echo2: 8483
2003/7/17 16:46:23 : new value: 190   max signal: 11222
2003/7/17 16:46:24 : new value: 188   max signal: 11337
2003/7/17 16:46:25 : new value: 186   max signal: 11361
2003/7/17 16:46:25 : new value: 184   max signal: 11394
2003/7/17 16:46:32 : Calculated value: 184

2003/7/17 16:46:32 : CTarClass[CDT_guatx_180]::ScriviPredef.RESULTS (p_180)
2003/7/17 16:46:32 : Index 1 - value: 184
```

Manual Operation

- Put the coil with the suitable phantom into the magnet and per-form a Scout selecting the district <Other> and <A> bed patient
- Under ARAS select **<Tests> <Manual> < RF 180 Gain>**, then **<Exec>**
- Adjust the **<Gain 1>** to bring the signal to about 20 K

Fig. 307: 180° Pulse not maximized



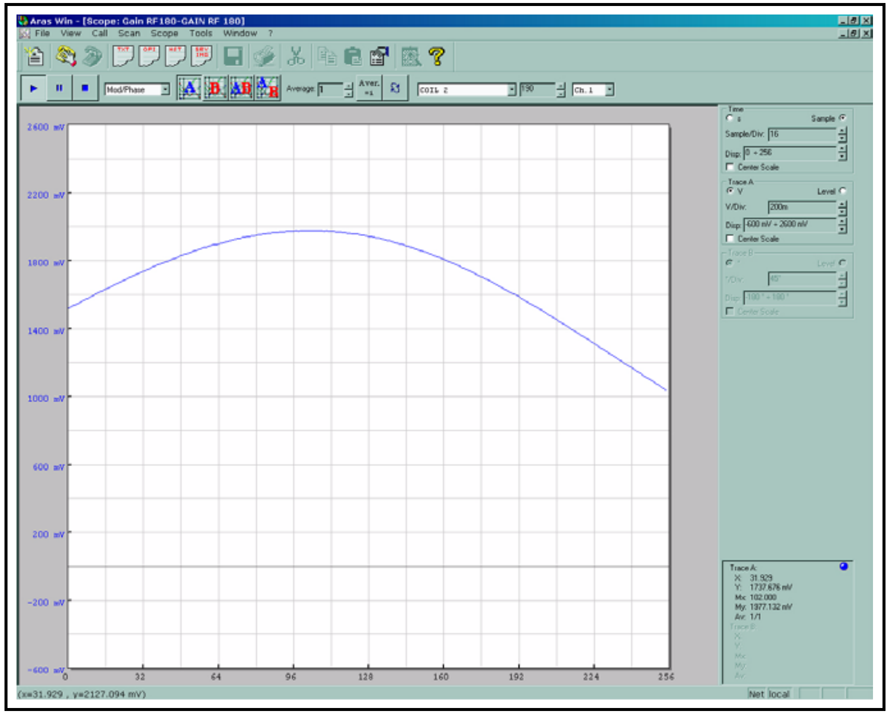
Sample/Div: 16
Disp: 0 ÷ 256
☐ Center Scale
V/Div: 200m
Disp: -600 mV ÷ 2600 mV
☐ Center Scale

Trace A:
X: 70.414
Y: 1364.330 mV
Mx: 103.000
My: 1401.174 mV
Av: 1/1

(x=70.414 , y=1937.931 mV)

- Select the 180° channel adjust the pulse to get the maximum value of the signal without taking care of its position

Fig. 308: 180° Pulse correctly maximized



Sample/Div: 16
Disp: 0 ÷ 256
☐ Center Scale
V/Div: 200m
Disp: -600 mV ÷ 2600 mV
☐ Center Scale

Trace A:
X: 31.929
Y: 1737.676 mV
Mx: 102.000
My: 1977.132 mV
Av: 1/1

(x=31.929 , y=2127.094 mV)

- Quit and save the variable
- If the values are correct, fill in the **Installation Quality Form** with the saved value

Sequence Calibration

Introduction

The purpose of this calibration is to adjust the Echo peak generated by the sequence: an echo is considered “calibrated” when its amplitude is the maximum obtainable. The G SLICE change (the range value is between -32767 and + 32767) is necessary to find out the condition of maximum signal. Write down the value on the form.

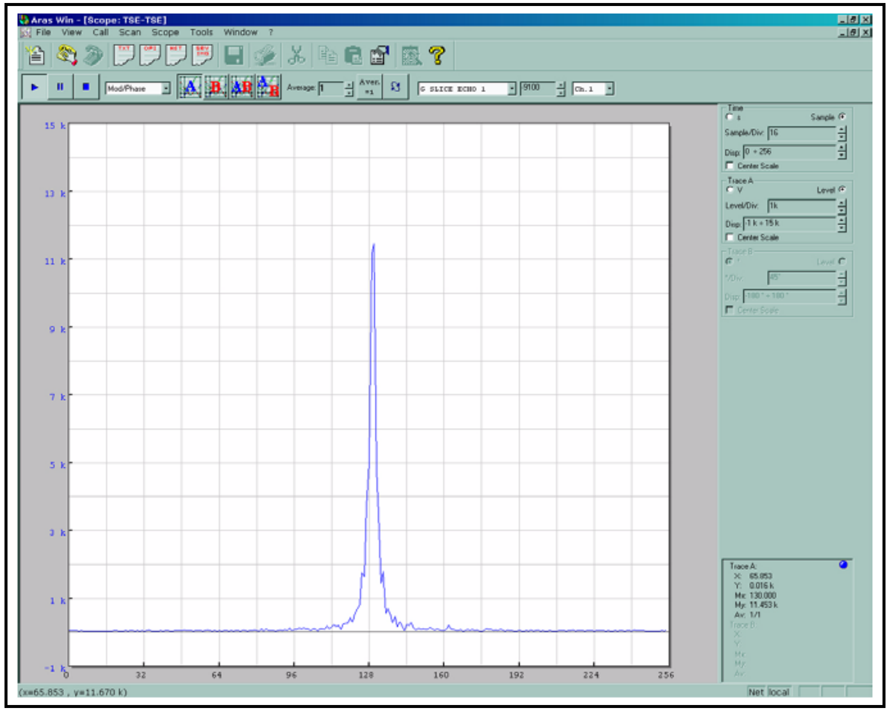
Necessary tools

– Geometrical Phantom and its support

Operation

- Place the Knee Coil 2 with the geometrical phantom in the Axial position
- Under ARAS select **<Test>** and **<Sequences>**
- Select the sequence inside the above mentioned menus and click on the **<Exec>** button. This operation allows starting up the “Diascope” program
- Change the **<Gain1>** and if necessary **<Gain2>** values to display the amplitude signal with the peak on 4/5 of the full screen

Fig. 309: Channel Peak not maximized

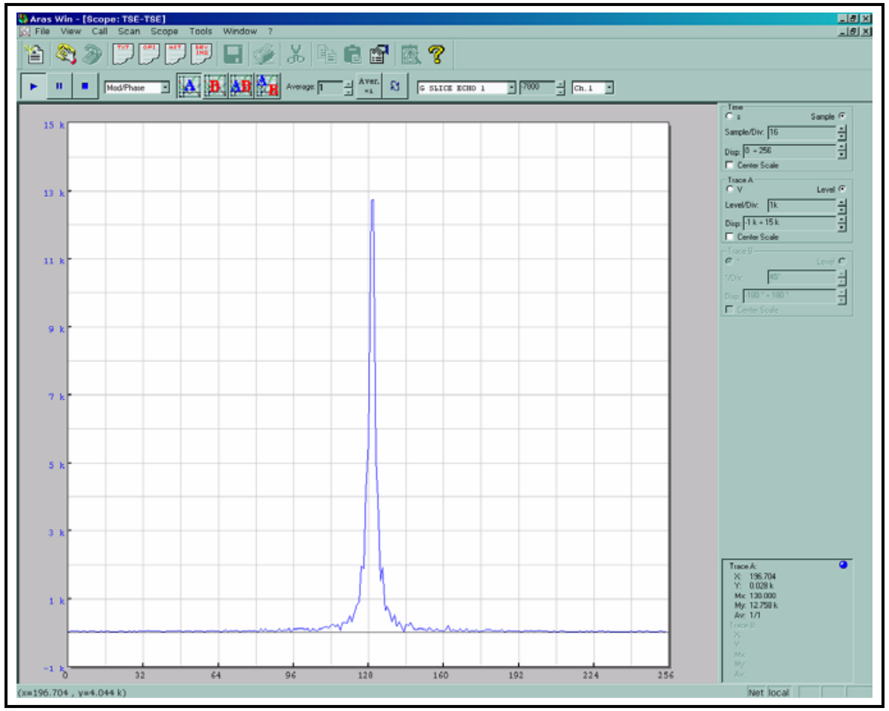


Trace A:
X: 65.853
Y: 0.016 k
Mx: 130.000
My: 11.453 k
Av: 1/1

(x=65.853 , y=11.670 k)

- Change the **<Channel>** number, using the arrows, till the **<G SLICE>** name is displayed. By clicking the GSLICE arrows change the **<G SLICE>** value to reach the highest peak value. The amplitude of the peak can be read in the information window at the bottom right corner of the screen under the variable named **<May>**

Fig. 310: Maximized Sequence peak



Mod/Phase

Average: 1

G SLICE ECHO 1

7800

Ch. 1

Time

○ s Sample ●

Sample/Div: 16

Disp: 0 ÷ 256

☐ Center Scale

Trace A

○ V Level ●

Level/Div: 1k

Disp: -1 k ÷ 15 k

☐ Center Scale

Trace B

● ° Level ○

°/Div: 45°

Disp: -180 ° ÷ 180 °

☐ Center Scale

Trace A:
X: 196.704
Y: 0.028 k
Mx: 130.000
My: 12.758 k
Av: 1/1
Trace B:
X:
Y:
Mx:
My:
Av:

(x=196.704 , y=4.044 k)

- Quit and save the variables
- If the values are correct, fill in the **Installation Quality Form** with the saved values

NOTICE	In the sequences TSE and TME three different echoes must be adjusted. Every echo has its own G SLICE value

- Repeat this procedure for the other sequence

Part 7 Magnetic Compensation

Introduction

This chapter describes the Magnetic Compensation Procedures for external DC and AC (50, 60 and 16.6 Hz) noise.

NOTICE	Perform the magnetic compensation procedures during the site working hours

No Magnetic Compensation

If **No** magnetic compensation is necessary, set as follow:

- Under ARAS select **<Test> <EFI> <DC Fine (50 Hz)>** and set **COARSE DC1 GAIN** to zero then quit saving it
- Select **<EFI AC 16 Hz>** and set **COARSE COMMON GAIN** to zero

Sources of DC Interference

Trucks, subways, elevators, escalators and fans or other kinds of iron masses running close to the magnet can generate DC noise.

NOTICE	It is possible to compensate only one DC source

Sources of AC interference

Power cable or railways close to the site.

Perform compensation during working hours when all the Systems are on and the noises are usually stronger.

NOTICE	It is possible to compensate two AC sources

Magnetic Compensation Flag Settings

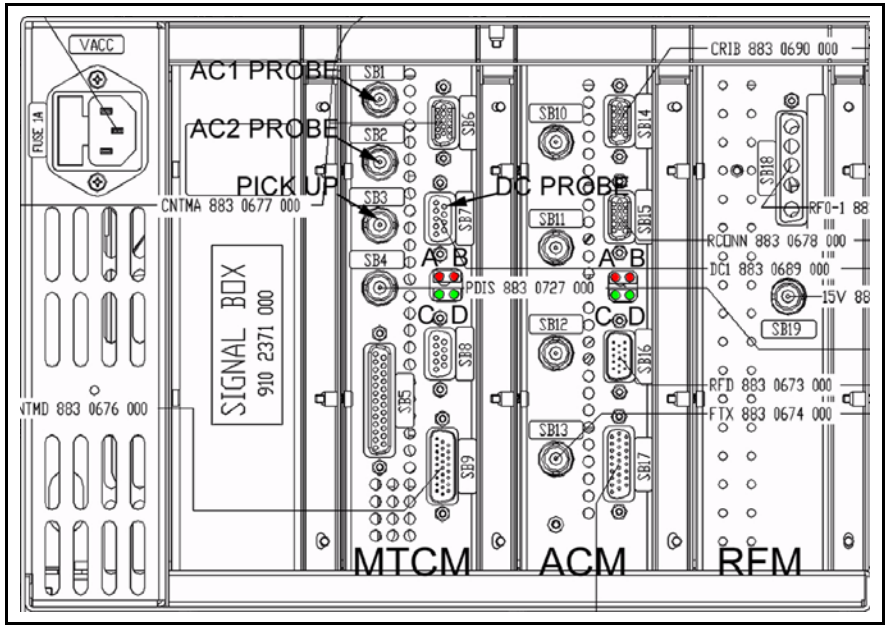
Before to start with the magnetic compensation procedure it's necessary to correctly set the MTCM flag (Internet Explorer, **<HW Configuration>** page) in according with the magnetic compensation procedure you are going to apply (refer to the next table).

Tab. 9: Compensation Flag Settings

Flag	Meaning
9500997000 - IC=0 (single probe)	Only one probe (DC probe) to measure the external DC variations and the external AC variations
9500997000 - IC=0 (multi probe)	One probe to measure the external DC variations and one (or two) probe to measure the external AC variations

The Magnetic Probes (DC and AC) must be connected to the MTCM module placed inside the Signal Box inside the Electronic Box.

Fig. 311: MTCM



Hardware set-up

DC Probe or Single Probe

In the next figure all the DC Probe support components and all the screws, bolts and washers that are necessary for the DC probe installation are shown.

The DC probe is already installed on its support, as shown.

Fig. 312: DC Probe support components

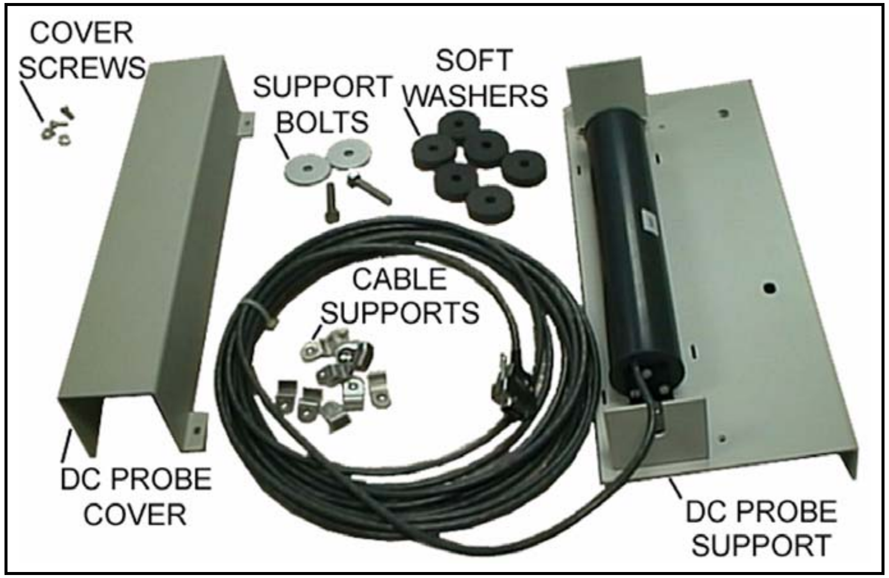
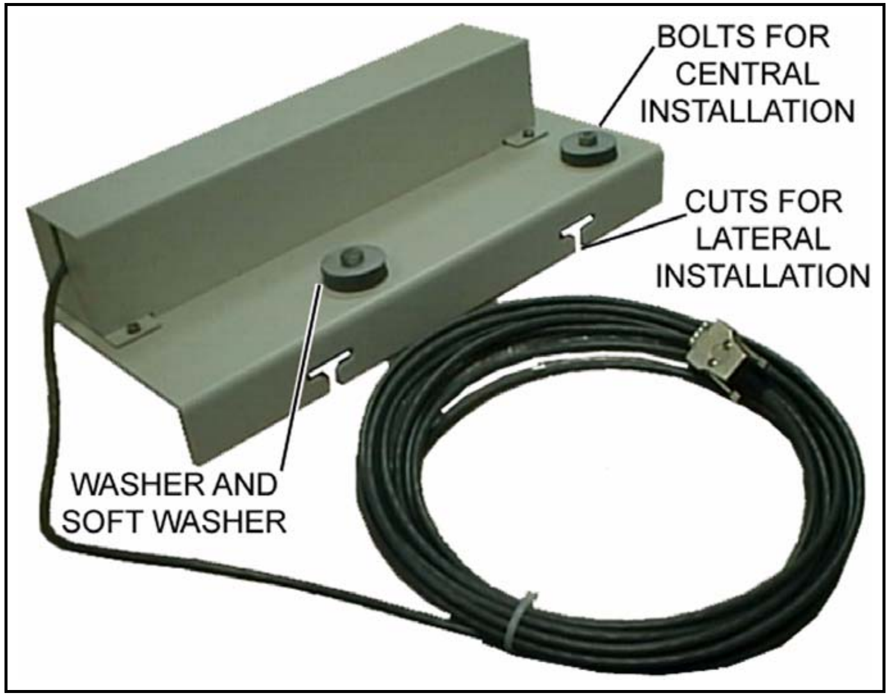


Fig. 313: Upper and Lower Cover Installed

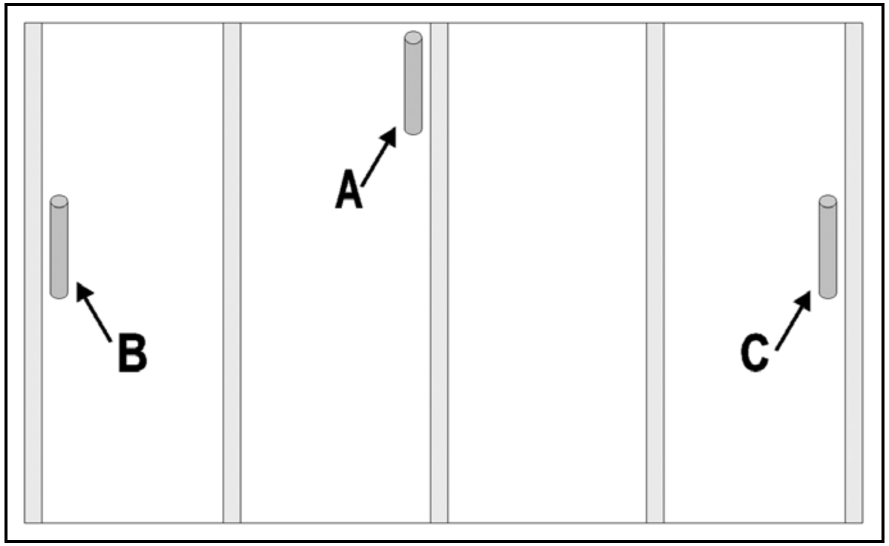


Probe Positioning

When positioning the probe there are three different positions inside the cage using the suitable support.

In the next figure the rear wall of the pavilion and the probe positions are shown (Pavilion internal view).

Fig. 314: DC Probe Positioning



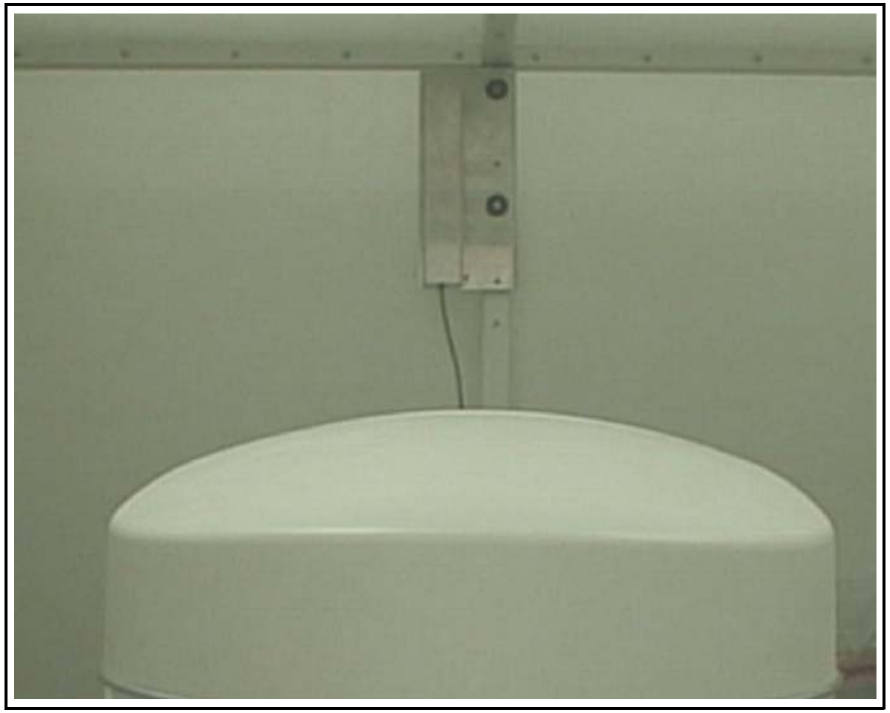
The indicated position A (central) is the most common.

The side positions B & C are used in the event of strong vibration or when the central position is too close to the magnetic noise source.

To fix the probe in the B or C position use the side slots of the probe support.

Obviously the B or C position could be not available in according with the Electronic Unit positioning.

Fig. 315: Example of Central Probe Positioning (A)



Insert one soft washer and one washer per bolt between the probe support and the bolt head and insert two of them per bolt between the probe support and the pavilion. The soft washers are used to reduce the effect of the pavilion vibrations.

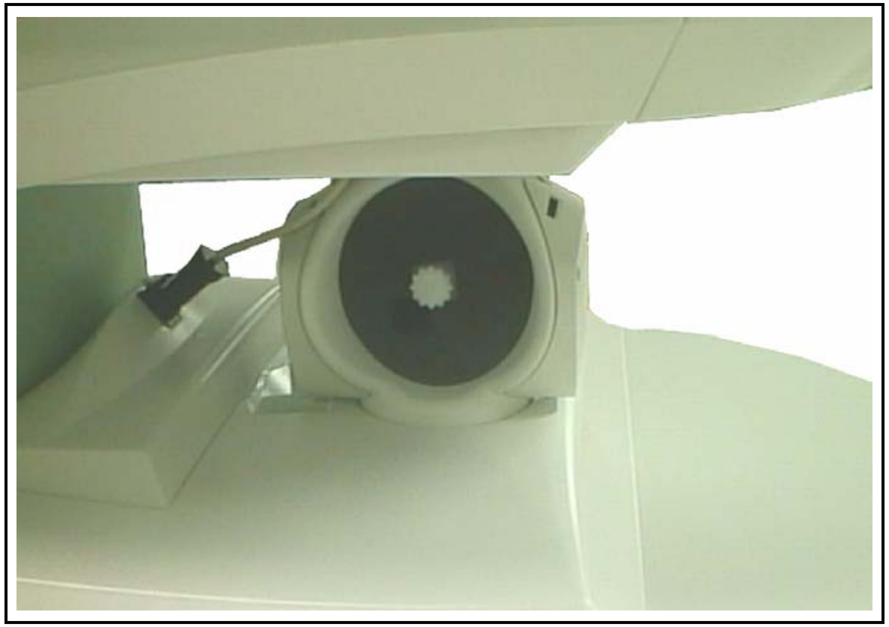
Fix the probe cable along the pavilion edge using the cable supports contained in the magnetic compensation kit.

NOTICE	Use the two upper screws of the central joint for A position and the two screws at the magnet center level of the lateral joint for B and C position.

DC Compensation

- Open the console front covers and connect the DC probe cable connector to the **FCMAG** connector of Electronic Unit filter panel
- Insert the Knee Coil 2 with the Ghost Phantom 25 ml placed in the center hole of its soft support (see the next figure) and perform a scout selecting the district **<Other>** and **<A>** bed patient

Fig. 316: Ghost Phantom position for DC compensation



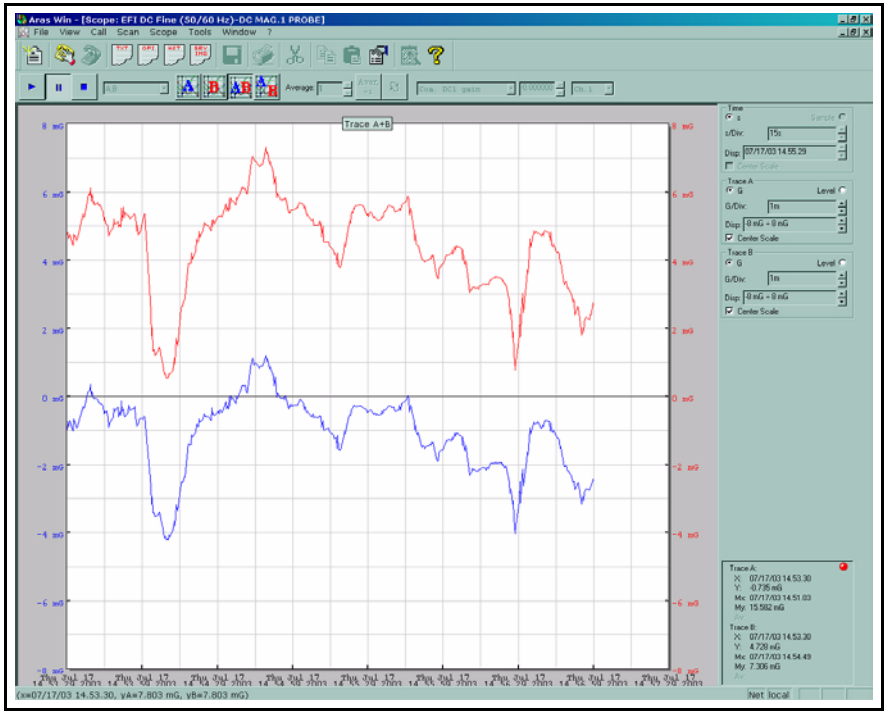
- Under ARAS, select **<Test> <EFI>**. The menu 3 buttons: each button minimizes interference respectively of 50, 60 or 50/16 Hz AC to better visualize the DC internal field. Performing the Stability test it's possible to know if AC noises are present and select the corresponding DC button. If no AC noise are present select **<DC Fine (50 Hz)>**. These features are based on analysis and computation of the NMR signal to measure the internal magnetic field with a time resolution of 3 samples per second
- Wait for the diascope display then change the Channel to display and set the following variables in according to the Pavilion installed (made of iron or aluminum). In case of different shielding cage installed then the Pavilion use the Iron values

Tab. 10: Settings due to the Pavilion metallic structure

Variable	**ALUMINUM**	**IRON (or other cages)**
Gain 1 Slow	-29	-30
Gain 1 Mid	100	50
Gain 1 Fast	100	0
Tau 1 Slow	100	270
Tau 1 Mid	4	10
Tau 1 Fast	0.8	3.3

- Select **<A>** channel (blue-internal field) and set the **<Y>** scale to 1 mG/Div (suggested starting value-decrease the scale during compensation), use **DISPLACEMENT** to move the trace on the monitor
- Select **<B>** channel (red-external noise) and set the **<Y>** scale to 1 mG/Div (suggested value) use **DISPLACEMENT** to move the trace on the monitor
- Select **<AB>** to display the internal and external DC noises (blue and red traces respectively)
- Set the **COARSE DC1 GAIN** to zero and compare the two traces: they must be very similar (like shown in the next figure). In case of different traces move the DC probe to another pre-defined position and repeat this procedure

Fig. 317: Traces without magnetic compensation (same shape) (external and internal trace scale 1 mG)


Aras Win - [Scope: EFI DC Fine (50/60 Hz)-DC MAG.1 PROBE]
File View Call Scan Scope Tools Window ?
Average:
Coa. DC1 gain
Trace A+B
8 mG
6 mG
4 mG
2 mG
0 mG
-2 mG
-4 mG
-6 mG
-8 mG
Net local

Time: ● s ○ Sample
s/Div: 15s
Disp: 07/17/03 14.55.29
☐ Center Scale

Trace A: ● G ○ Level
G/Div: 1m
Disp: -8 mG ÷ 8 mG
☑ Center Scale

Trace B: ● G ○ Level
G/Div: 1m
Disp: -8 mG ÷ 8 mG
☑ Center Scale

Trace A:
X: 07/17/03 14.53.30
Y: -0.735 mG
Mx: 07/17/03 14.51.03
My: 15.582 mG

Trace B:
X: 07/17/03 14.53.30
Y: 4.728 mG
Mx: 07/17/03 14.54.49
My: 7.306 mG

(x=07/17/03 14.53.30, yA=7.803 mG, yB=7.803 mG)

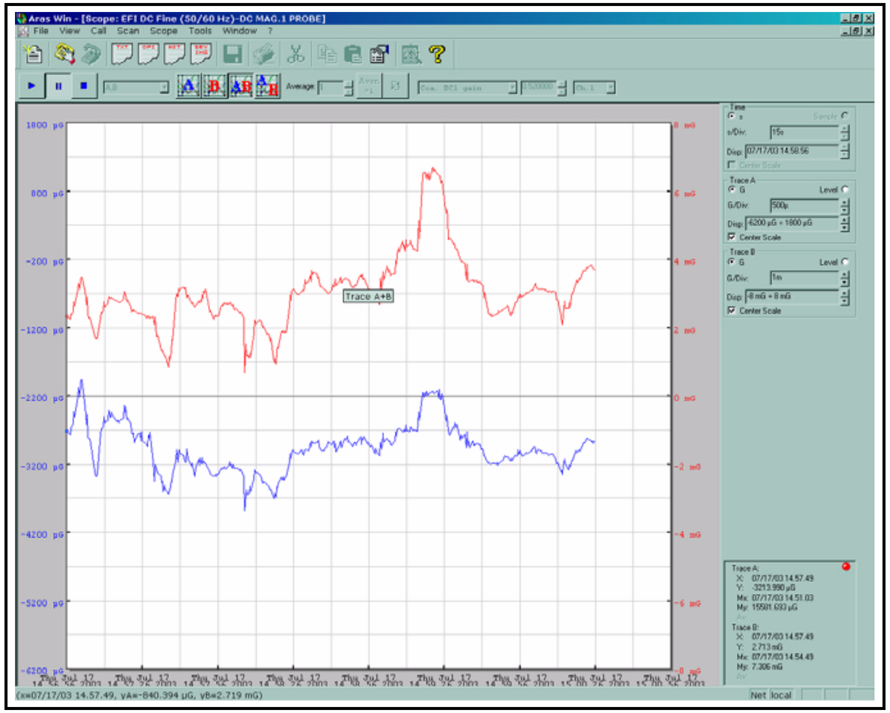
- Increase the **COARSE DC1 GAIN** carefully (three digital steps per time) starting to minimize the internal trace (blue one). Change the visualization scale of the internal trace to better understand if you are correctly proceeding

---

NOTICE	Increase the internal field scale to better visualize the trace and optimize the compensation

---

Fig. 318: Internal trace smaller then external one (external trace scale 1 mG while internal trace scale 0,5 mG)



Time: ● s ○ Sample
s/Div: 15s
Disp: 07/17/03 14.58.56
☐ Center Scale

Trace A: ● G ○ Level
G/Div: 500µ
Disp: -6200 µG ÷ 1800 µG
☑ Center Scale

Trace B: ● G ○ Level
G/Div: 1m
Disp: -8 mG ÷ 8 mG
☑ Center Scale

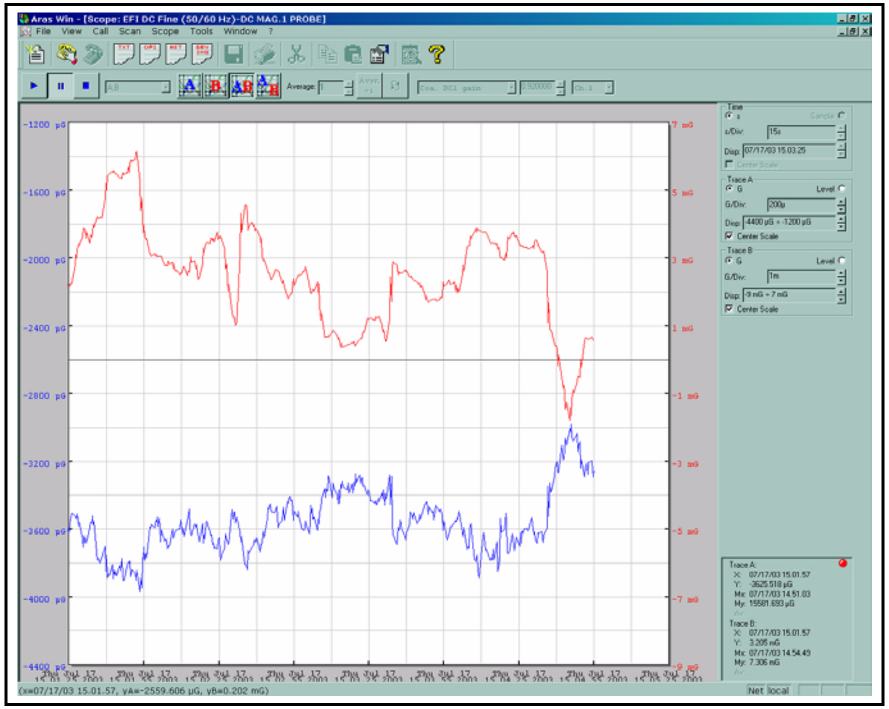
Trace A:
X: 07/17/03 14.57.49
Y: -3213.990 µG
Mx: 07/17/03 14.51.03
My: 15581.690 µG

Trace B:
X: 07/17/03 14.57.49
Y: 2.713 mG
Mx: 07/17/03 14.54.49
My: 7.306 mG

(x=07/17/03 14.57.49, yA=-840.394 µG, yB=2.719 mG)

- Increase the **COARSE DC1 GAIN** carefully (one digital step per time) till to over compensate the external variations (set the traces in opposite phase - symmetrical direction) then decrease the **COARSE DC1 GAIN** till to visualize again the traces with the variation in the same direction and start to increase the **FINE DC1 GAIN** and reduce the internal field till to met the specification (see next figures)

Fig. 319: Magnetic DC noise OVER compensated (external trace scale 1 mG while internal trace scale 0,2 mG)



Time
s/Div: 15s
Disp: 07/17/03 15.03.25
☐ Center Scale

Trace A
G/Div: 200µ
Disp: -4400 µG ÷ -1200 µG
☑ Center Scale

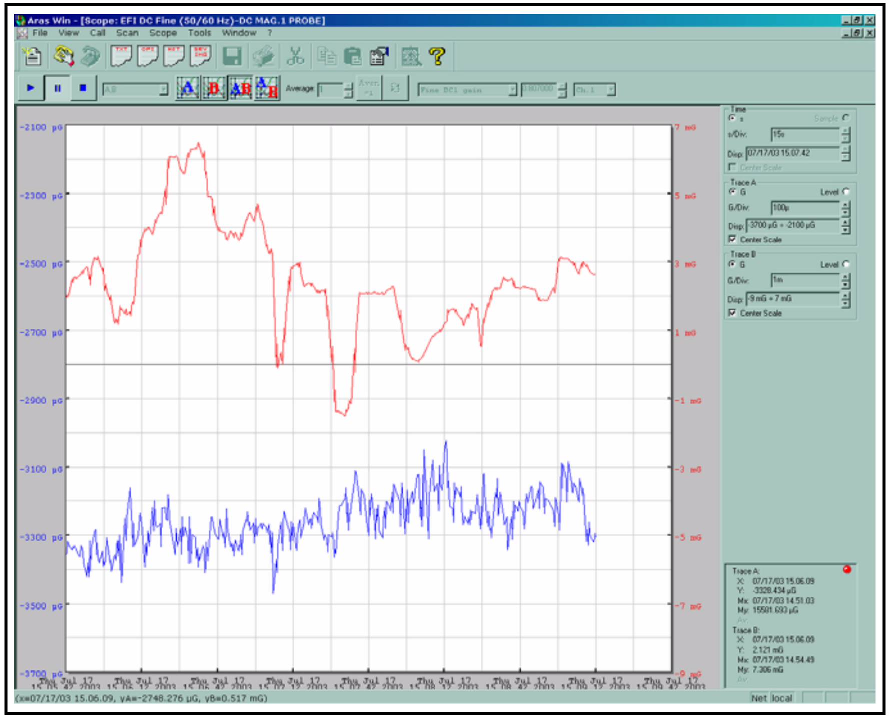
Trace B
G/Div: 1m
Disp: -9 mG ÷ 7 mG
☑ Center Scale

Trace A:
X: 07/17/03 15.01.57
Y: -3625.518 µG
Mx: 07/17/03 14.51.03
My: 15581.693 µG

Trace B:
X: 07/17/03 15.01.57
Y: 3.205 mG
Mx: 07/17/03 14.54.49
My: 7.306 mG

(x=07/17/03 15.01.57, yA=-2559.606 µG, yB=0.202 mG)

Fig. 320: External variations correctly compensated (external trace scale 1 mG while internal trace scale 0,1 mG)



Time
s/Div: 15s
Disp: 07/17/03 15.07.42
☐ Center Scale

Trace A
G/Div: 100µ
Disp: -3700 µG ÷ -2100 µG
☑ Center Scale

Trace B
G/Div: 1m
Disp: -9 mG ÷ 7 mG
☑ Center Scale

Trace A:
X: 07/17/03 15.06.09
Y: -3328.434 µG
Mx: 07/17/03 14.51.03
My: 15581.693 µG

Trace B:
X: 07/17/03 15.06.09
Y: 2.121 mG
Mx: 07/17/03 14.54.49
My: 7.306 mG

(x=07/17/03 15.06.09, yA=-2748.276 µG, yB=0.517 mG)

- At the end of the compensation procedure, perform the DC image test: in case of results out of spec repeat this procedure

AC Compensation

Multiple AC Sources

It's possible to compensate two AC noise sources, the possible couples are

- Two 50 Hz sources
- One 50 Hz source and one 16.6 Hz source
- Two 60 Hz sources
- No other possibilities are allowed

If **No** DC compensation is necessary (single or multi probe), set as follow:

- Under ARAS, select **<Test> <EFI> <EFI DC Fine (50 Hz)>** and set **COARSE DC1 GAIN** to zero then quit saving it

Probe Positioning (Multi Probe Configuration)

NOTICE	Perform this step only in case of Multi Probe Configuration otherwise skip it

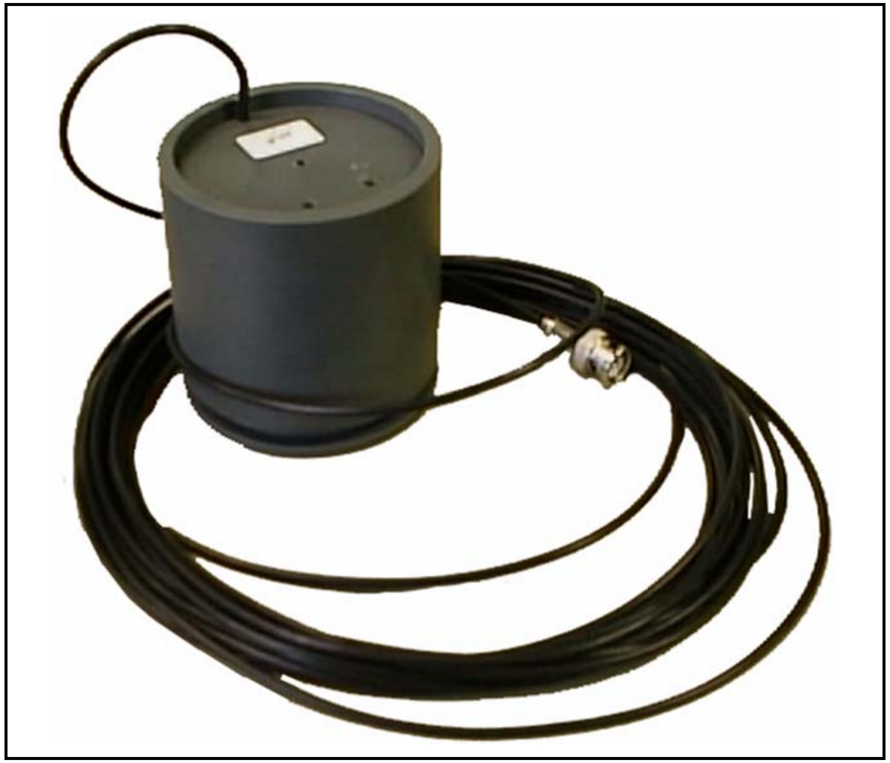
The AC probe must be placed only if the multi probe compensation is performed. Place it outside the pavilion, in a vertical position with the cable side on the bottom. The probe must be fixed on the wall at the end of the magnetic compensation procedure: use tape to fix it during the compensation.

The best probe position is between the noise source and the magnet but not too close to the noise source (e.g.: cables and ferromagnetic material), at the level of the magnet center (if possible). There should be a minimum distance of 2 meters between probes.

Use the magnetic compensation procedure to measure the external noise in order to identify where it is stronger and place the AC probe in that point. To do that, move the AC probe along the installation room walls. Also the rear pavilion wall is available if the distance between the wall and the pavilion is at least 30 cm.

NOTICE	The AC Probe must be fixed on the wall with the out cable side at the bottom

Fig. 321: AC probe (don't fix the probe like this but in the other way round)

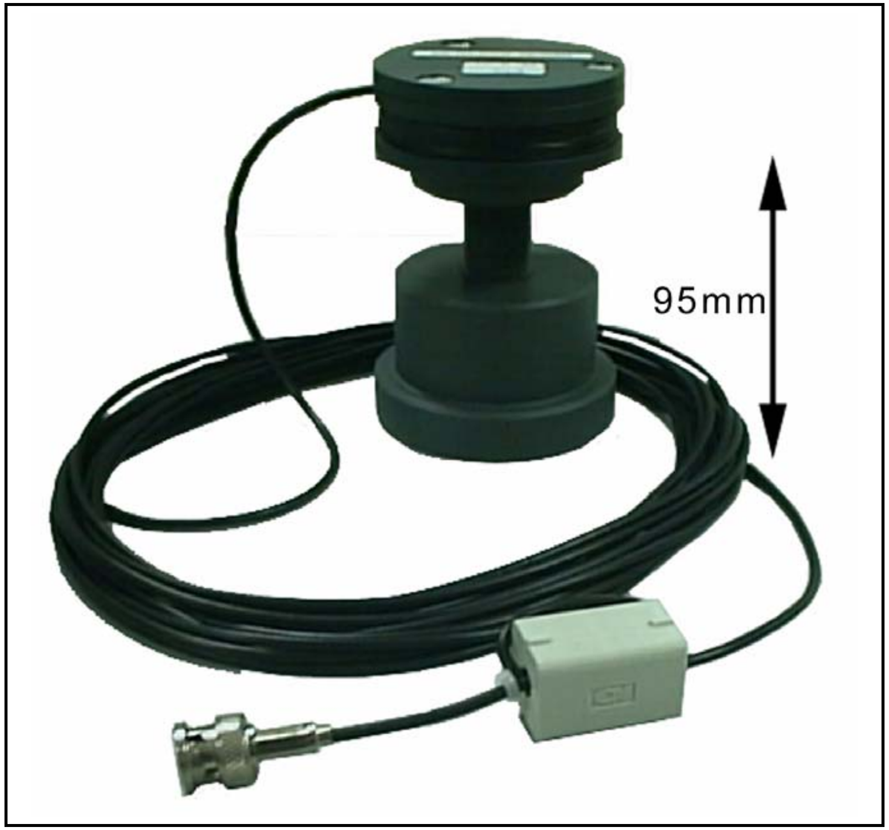


Pick-Up Coil Positioning

- Rotate the support till to set it at 95 mm height
- Place the support inside the magnet and put the connected PICKUP coil on it

NOTICE	There is a soft washer under the support to prevent vibration interference

Fig. 322: *Pick-up coil and its support*

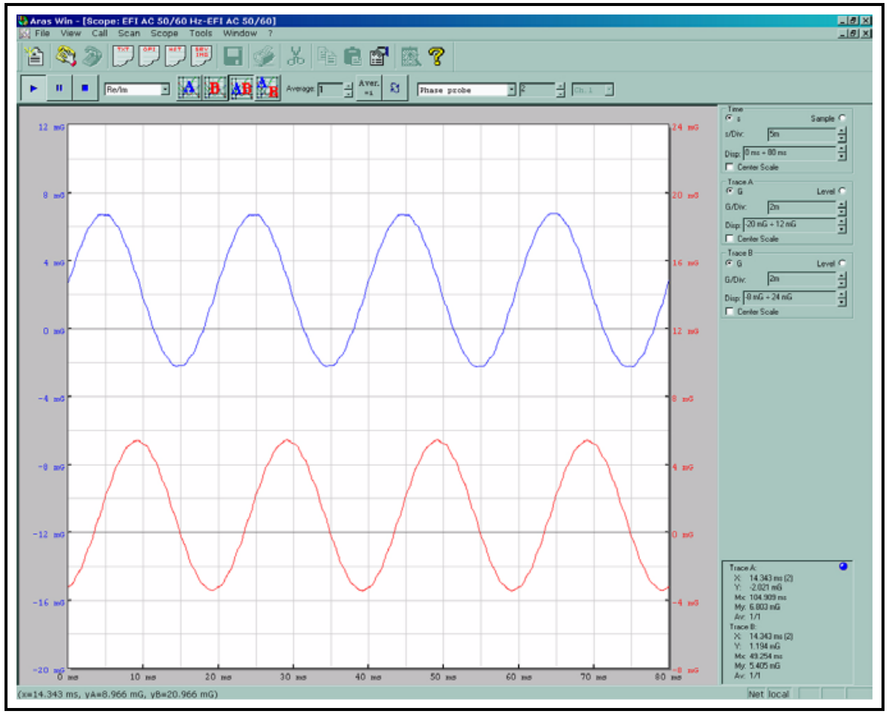


Single source procedure for 50/60 Hz

- Open the electronic unit
- Connect the Pick up coil to the **SB3** connector of the Signal Box (front side)
- If you are using the Multi Probe Procedure, connect the AC compensation probe to the **SB1** connector of the Signal Box (front side) otherwise skip this step
- Under ARAS select **<Test>** **<EFI>** then choose **<EFI AC 50/60 Hz>** button
- Wait for the diascope then select **<A>** channel (blue trace - internal field) and set the **<Y>** scale to 500 mG/Div (suggested value), use **DISPLACEMENT** to move the trace on the monitor
- Select **<B>** channel (red trace - external field) and set the **<Y>** scale to 1 mG/Div (suggested value), use **DISPLACEMENT** to move the trace on the monitor
- Select **<A-B>** to display the internal and external AC fields (blue and red traces respectively)
- Set the **PROBE 1 GAIN** to one, **PROBE 2 GAIN** to one, **PHASE PROBE 2** to two and **COARSE COMMON GAIN** to zero

NOTICE	If the external field is very noisy, set the AVERAGE to 4 or 5 but the traces will appear smaller than they are

Fig. 323: Traces not in phase (external and internal trace scale 2 mg)

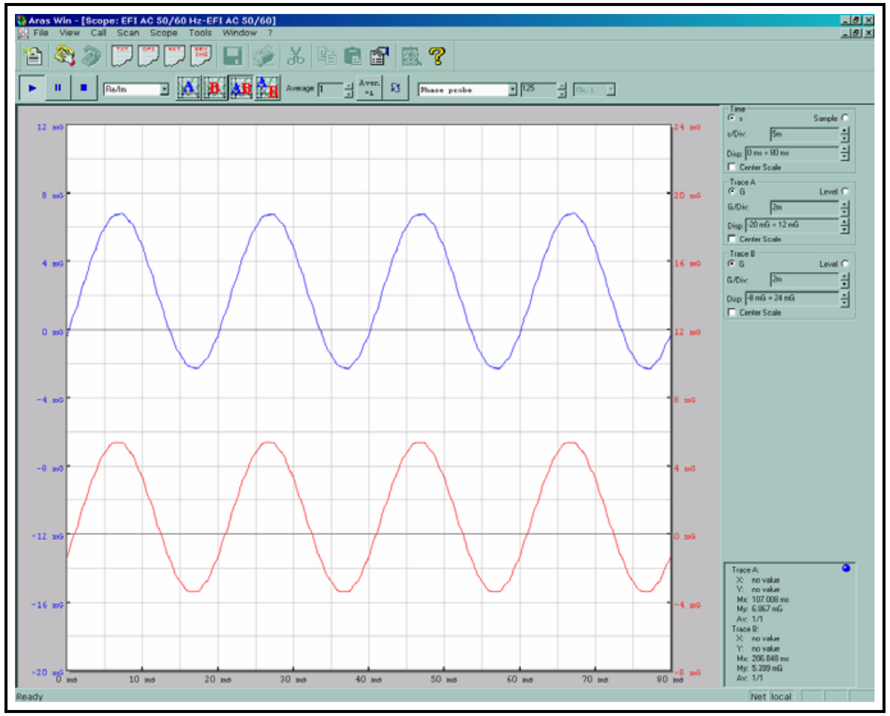


(x=14.343 ms, yA=8.966 mG, yB=20.966 mG)

- Now increase (or decrease) the **PHASE PROBE 1** value till to put the external AC noise (red trace) in phase with the internal noise (blue trace) (or opposite phase for 60 Hz compensation)

⚠**WARNING** **In case of 60 Hz compensation the trace must set in opposite phase to compensate an internal System inversion**

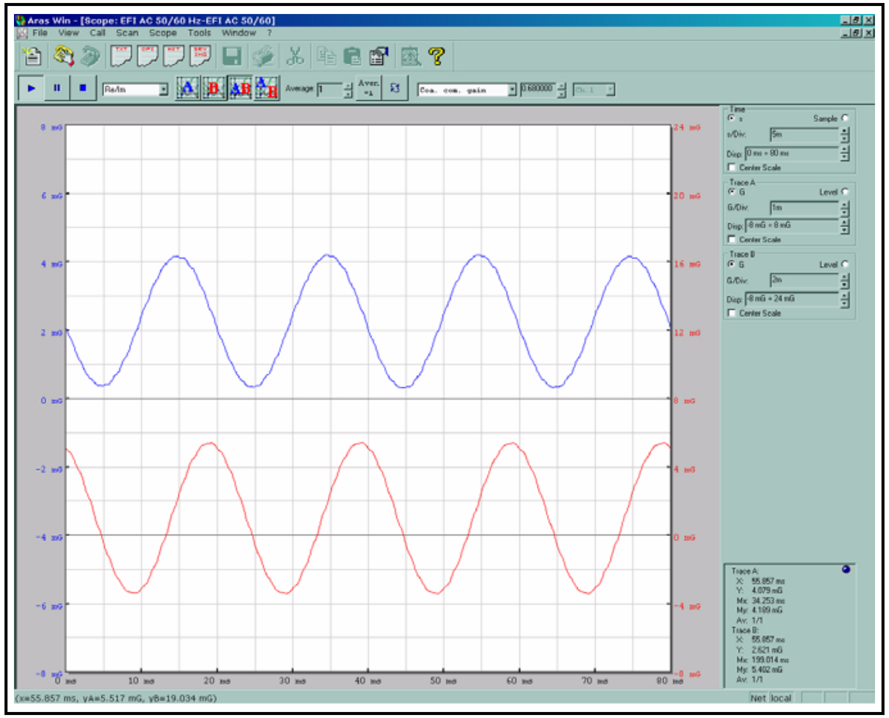
Fig. 324: Traces in phase (external and internal trace scale 2 mg)



- Now act on the **COARSE COMMON GAIN** till to reduce the internal AC field till to overcompensate it, then come back one digital step and act on the **FINE COMMON GAIN**

NOTICE Increase the internal field scale to better visualize the trace and optimize the compensation

Fig. 325: Decreased internal field but shifted (external trace scale 2 mG while internal trace scale 1 mg)



Time
● s ○ Sample
s/Div: 5m
Disp: 0 ms ÷ 80 ms
☐ Center Scale

Trace A
● G ○ Level
G/Div: 1m
Disp: -8 mG ÷ 8 mG
☐ Center Scale

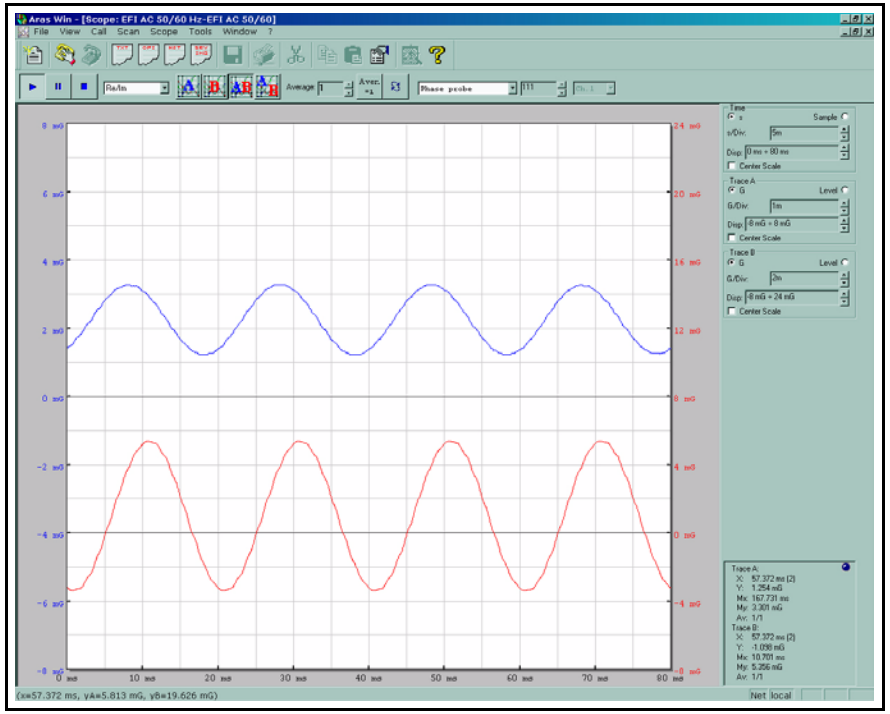
Trace B
● G ○ Level
G/Div: 2m
Disp: -8 mG ÷ 24 mG
☐ Center Scale

Trace A:
X: 55.857 ms
Y: 4.079 mG
Mx: 34.253 ms
My: 4.189 mG
Av: 1/1
Trace B:
X: 55.857 ms
Y: 2.621 mG
Mx: 199.014 ms
My: 5.402 mG
Av: 1/1

(x=55.857 ms, yA=5.517 mG, yB=19.034 mG)

- During the compensation will be necessary adjust again the **PHASE PROBE 1**, as shown in the next figure (increasing the GAIN the internal signal shifts)

Fig. 326: Decreased internal field and again in phase (external trace scale 2 mG while internal trace scale 1 mg)



Time
● s ○ Sample
s/Div: 5m
Disp: 0 ms ÷ 80 ms
☐ Center Scale

Trace A
● G ○ Level
G/Div: 1m
Disp: -8 mG ÷ 8 mG
☐ Center Scale

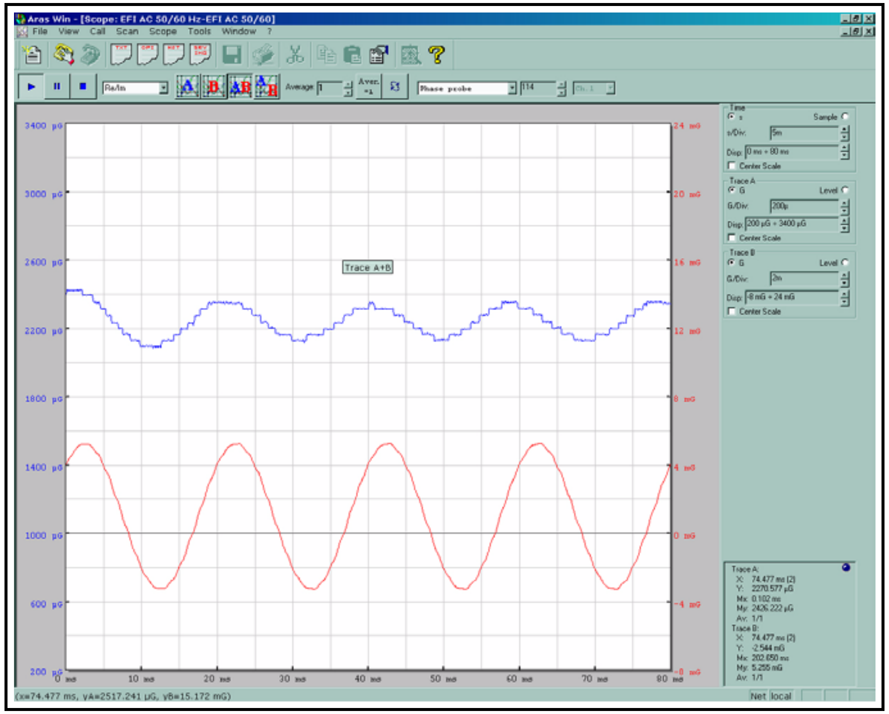
Trace B
● G ○ Level
G/Div: 2m
Disp: -8 mG ÷ 24 mG
☐ Center Scale

Trace A:
X: 57.372 ms (2)
Y: 1.254 mG
Mx: 167.731 ms
My: 3.301 mG
Av: 1/1
Trace B:
X: 57.372 ms (2)
Y: -1.098 mG
Mx: 10.701 ms
My: 5.256 mG
Av: 1/1

(x=57.372 ms, yA=5.813 mG, yB=19.626 mG)

- Increase **FINE COMMON GAIN** till to reduce the internal field in specification

Fig. 327: Correctly internal trace (external trace scale 2 mG while internal trace scale 0,2 mg)



Time
● s Sample ○
s/Div: 5m
Disp: 0 ms ÷ 80 ms
☐ Center Scale

Trace A
● G Level ○
G/Div: 200µ
Disp: 200 µG ÷ 3400 µG
☐ Center Scale

Trace B
● G Level ○
G/Div: 2m
Disp: -8 mG ÷ 24 mG
☐ Center Scale

Trace A:
X: 74.477 ms (2)
Y: 2270.577 µG
Mx: 0.102 ms
My: 2426.222 µG
Av: 1/1
Trace B:
X: 74.477 ms (2)
Y: -2.544 mG
Mx: 202.650 ms
My: 5.255 mG
Av: 1/1

(x=74.477 ms, yA=2517.241 µG, yB=15.172 mG)

- Quit and save all the variables
- Perform the AC Quality Test contained in the next chapter. In case of bad results repeat this procedure

Single source procedure for 16 Hz

- Open the electronic unit rear covers
- Connect the Pick up coil to the **SB3** connector of the Signal Box (front side)
- Connect the AC compensation probe to **SB1** connector of the Signal Box (front side)
- Under ARAS select **<Test> <EFI>** then choose **<EFI AC 50/60 Hz>** button and set **GAIN PROBE 2** to zero and save it
- Quit for the diascope
- Under ARAS select **<Test> <EFI>** then choose **<EFI AC 16 Hz>** button
- Wait for the diascope then select **<A>** channel (internal field) and set the **<Y>** scale to 0,5 mG/Div (suggested value), use **DISPLACEMENT** to move the trace on the monitor
- Select **<B>** channel (external field) and set the **<Y>** scale to 1 mG/Div (suggested value), use **DISPLACEMENT** to move the trace on the monitor
- Select **<DUAL>** to display the internal and external AC fields (blue and red traces respectively)
- Set the **GAIN PROBE** to zero

NOTICE	If the external field is very noisy, set the AVERAGE to 4 or 5 but the traces will appear smaller than they are

- Now increase (or decrease) the **PHASE PROBE** value till to put the external AC noise (gray trace) in phase with the internal noise (blue trace)
- Now act on the **GAIN PROBE** till to reduce the internal AC field in specification
- If necessary adjust the **PHASE PROBE**

NOTICE	Increase the internal field Y scale to better visualize the trace

- Increase carefully the **GAIN PROBE** to avoid over compensation
- Quit and save all the variables
- When the specification is met perform the AC Quality Test contained in the next chapter. In case of bad results repeat this procedure

Double sources procedure

NOTICE	It's possible to compensate only two 50 Hz noises or one 50 Hz and one 16 Hz noises or two 60 Hz noises. No other combinations are allowed

- Open the electronic unit rear covers
- Connect the Pick up coil to the **SB3** connector of the Signal Box (front side)
- Connect the AC compensation probes to the **SB1** and **SB2** connectors of the Signal Box (front side)
- Under ARAS select **<Test> <EFI>** then **<50/60 Hz>** button
- Wait for the diascope then select **<A>** channel (internal field) and set the **<Y>** scale to 0.5 mG/Div (suggested value), use **DISPLACEMENT** to move the trace on the monitor
- Select **<B>** channel (external field) and set the **<Y>** scale to 1 mG/Div (suggested value), use **DISPLACEMENT** to move the trace on the monitor
- Select **<DUAL>** to display the internal and external AC noises (blue and red traces respectively)
- Set the **GAIN PROBE 1** to one, **GAIN PROBE 2** to zero (to eliminate the second AC noise effect), **PHASE PROBE 2** to two and **GAIN COMMON** to zero
- Measure the external AC fields:
  - Move the AC probe connect to the **SB1** connector of the Signal Box (front side) along the room walls to measure the two AC souses
  - Take care of the measured values
- Place the AC probe on the wall and start to compensate the strongest noise
- Now increase (or decrease) the **PHASE PROBE 1** value till to put the external AC noise (gray trace) in phase with the internal noise (blue trace)

NOTICE	In case of 60 Hz compensation the traces must set in opposite phase to compensate an internal System inversion

- Increase the **COMMON GAIN** till to reduce as much as possible the internal field
- Place the second AC probe in order to compensate the smaller AC external source

NOTICE	Also if two external Probes are connected to the System, the External Trace visualized on monitor is only one and corresponds to the sum of the External Magnetic Fluctuations

- Increase the **GAIN PROBE 2** (now the visualized external field is the balanced sum of the two external components) till to reduce the internal field in specification
- Act on **PHASE PROBE 1** and **PHASE PROBE 2** if necessary
- Quit and save all the variables
- When the specification is met perform the AC Quality Test contained in the next chapter. In case of bad results repeat this procedure

Part 8 Quality Assurance

Introduction

All the necessary tests for checking the System image quality will be described in this chapter:

- Signal to Noise Check
- Uniformity Test
- Ghost Test
- Stability Test
- Lines on Image

NOTICE The "PREZOOM" user's option must be disabled (uncheck the Prezoom performing the log on like ESAMRI and selecting Image and Viewer)

Refer to the Phantoms paragraph for the Coils and Phantoms settings during the Quality Test.

AFTER THE QUALITY ASSURANCE TEST PERFORM A SYSTEM BACK-UP (REFER TO THE SYSTEM BACK-UP CHAPTER OF THIS MANUAL)

Signal to noise check

Introduction

The signal-noise ratio test is the most important test and, at the same time, the most critical since it is affected by the operation of the entire machine and not by a single parameter. The evaluation is performed on images obtained with the homogeneous phantoms and the different coils for the three main views: Axial, Sagittal, and Coronal. This measurement must be repeated with different scans, so you can be absolutely certain that the machine is operating correctly.

The displayed value is obtained applying the following calculation:

S/N= (A / SD1 + A / SD2 + A / SD3 + A / SD4) /4

Where M is the average value of the signal of the central ROI and SDn is the standard deviation value of the corner ROIs.

NOTICE	The "PREZOOM" user's option must be disabled

Necessary tools

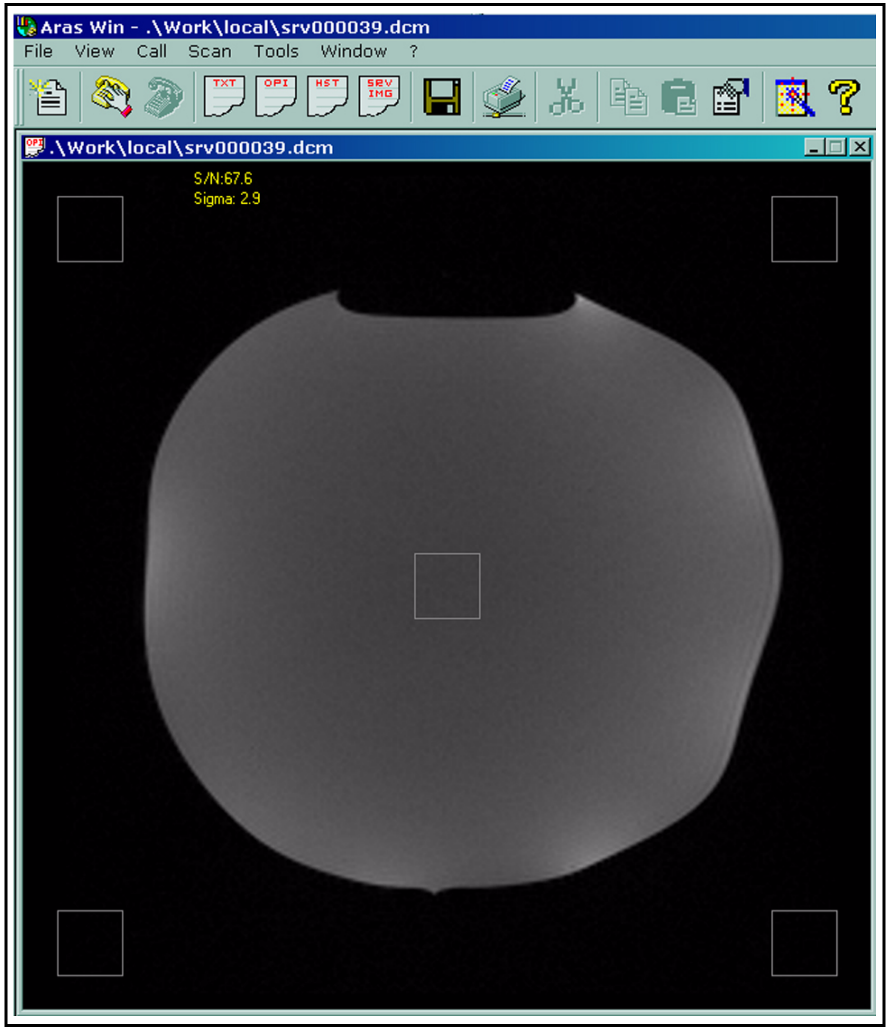
– Homogeneous Phantoms and supports

Operations

- Insert the Coil in with the suitable phantom and perform a scout selecting the district <**Other**> and <**A**> bed patient
- Under OPI Click select **<Protocol List>** then select the correct sequences following the Installation Quality Form and start them
- Wait for the images are acquired then under ARAS open the correct image and write the value on the Installation Quality Form
- Repeat for the other sequences and coil following the form

NOTICE	The Shoulder Coil 5 must be placed in axial position (along the X axis)

Fig. 328: Signal to noise measurements


Aras Win - .\Work\local\srv000039.dcm
File
View
Call
Scan
Tools
Window
?
TXT
OPI
HST
SRV IMG
.\Work\local\srv000039.dcm

S/N:67.6
Sigma: 2.9

Uniformity test

Introduction

Image uniformity is evaluated on the homogeneous phantom following the NEMA protocol that defines this parameter as follows:

U% = 100 x [(Smax-Smin) / (Smax+Smin)]

Where Smax and Smin are the maximum and the minimum signals in a circular ROI centered in the phantom's image.

Following the same procedure explained before for the signal to Noise test, perform the Uniformity test just for the Knee Coil 2, in axial orientation.

NOTICE The "PREZOOM" user's option must be disabled

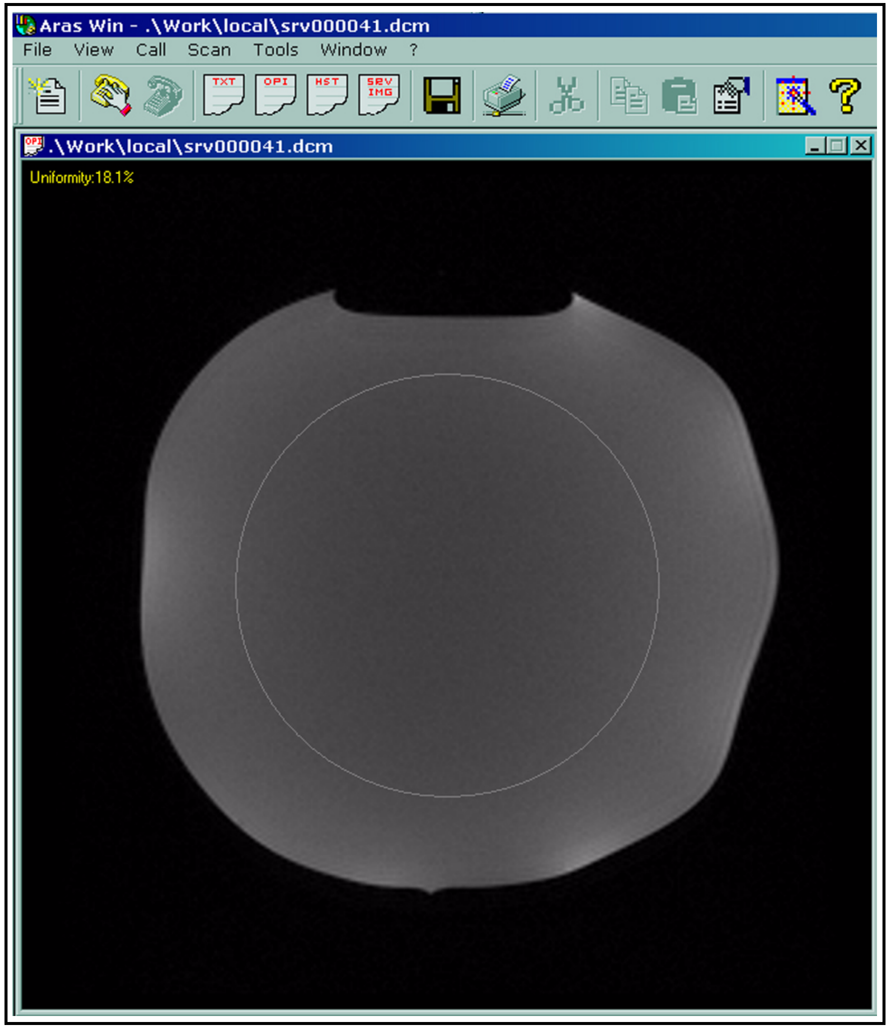
Necessary tools

– Big Spherical Phantom and its supports

Operations

- Insert the Knee Coil 2 in Axial position with the suitable phantom in it and perform a Scout selecting the district <**Other**> and <**A**> bed patient
- Under OPI select **<Protocol List>** then select the correct sequences following the Installation Quality Form and start them
- Wait for the images to be obtained
- Under ARAS open the correct image and perform the measurement then write the value on the Installation Quality Form

Fig. 329: Uniformity measurement


Aras Win - .\Work\local\srv000041.dcm
File
View
Call
Scan
Tools
Window
?
TXT
OPI
HST
SRV IMG
.\Work\local\srv000041.dcm

Uniformity:18.1%

Ghost Test

NOTICE	The "PREZOOM" user's option must be disabled

Necessary tools

– Ghost phantom and its support

Fig. 330: Ghost phantom and its support

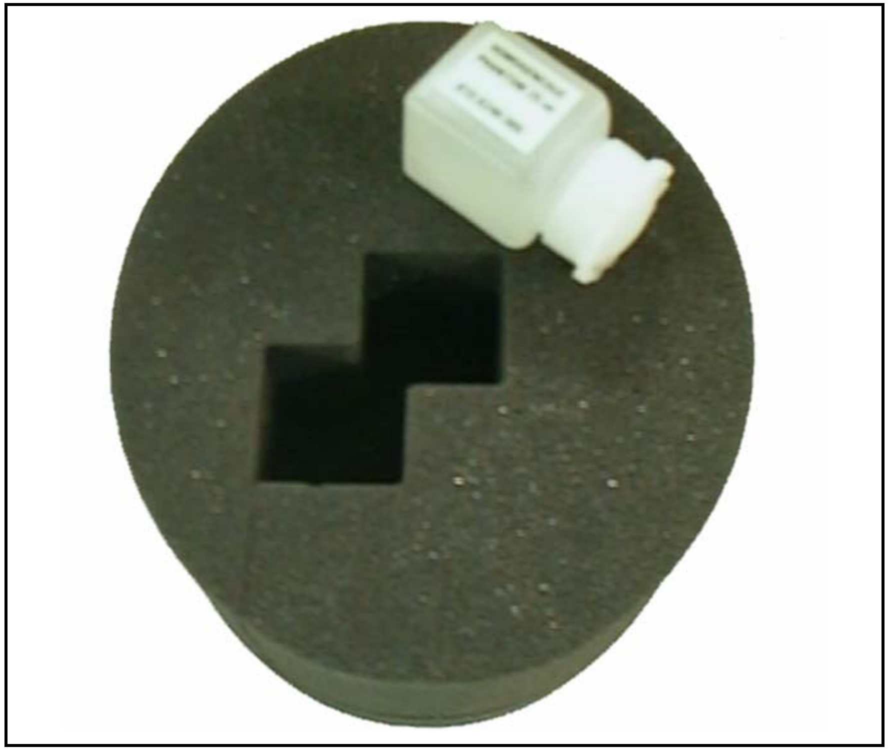
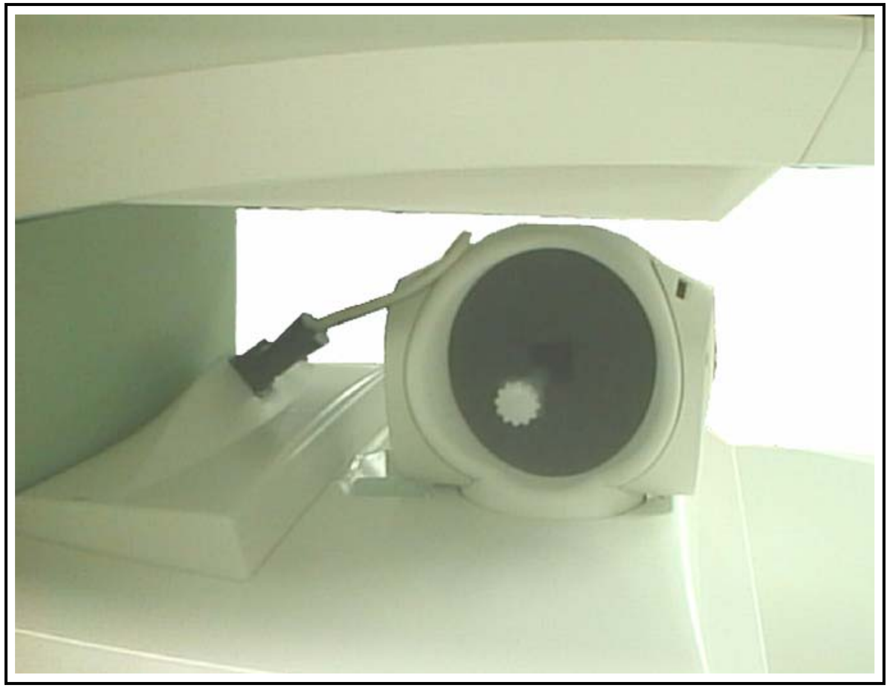


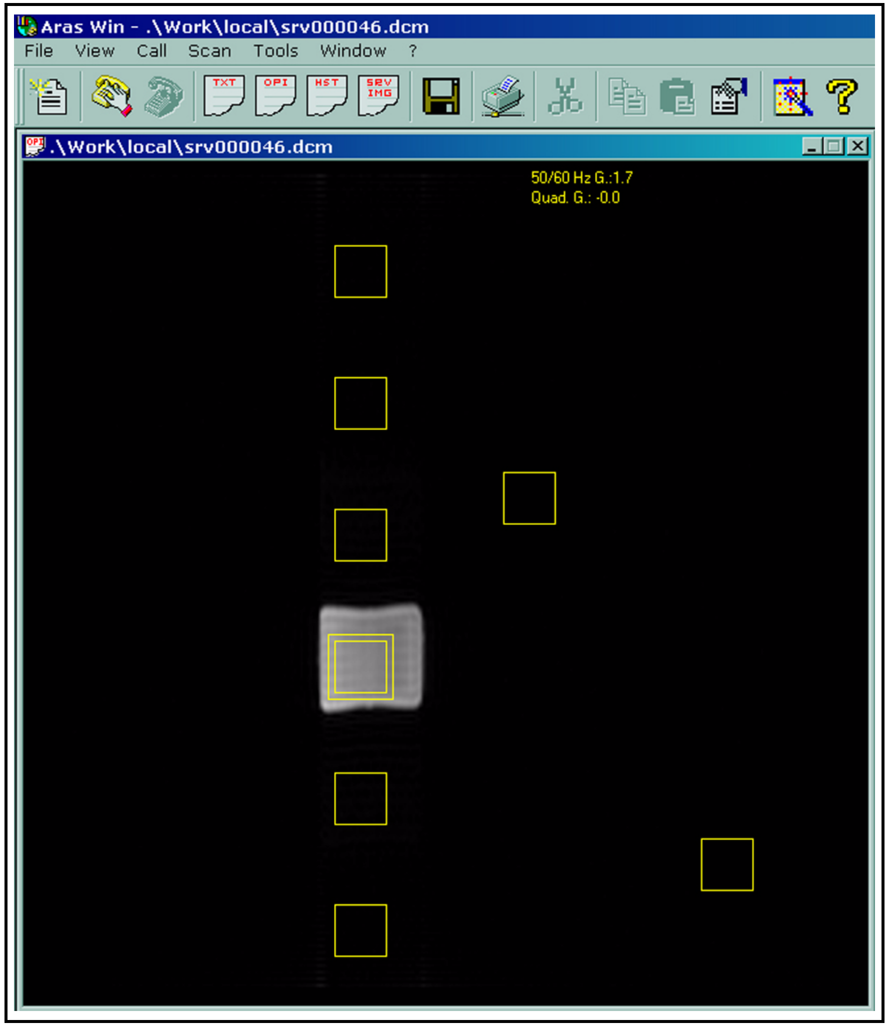
Fig. 331: Phantom and support inserted into the Knee coil



Operations

- Insert the Knee Coil 2 inside the Gantry with the small homogeneous phantom in it (like shown in the previous image)
- Under OPI Click select **<Protocol List>** then select the correct sequences following the Installation Quality Form and start them
- Wait for the images to be displayed
- Under ARAS open the correct image and perform the measurement then write the value on the Quality Form

Fig. 332: Axial Ghost measurement


Aras Win - .\Work\local\srv000046.dcm
File View Call Scan Tools Window ?
TXT
OPI
HST
SRV IMG
.\Work\local\srv000046.dcm

50/60 Hz G.:1.7
Quad. G.: -0.0

- **Ghost** and **Quad G** must be under 2%
  - If they are correct, fill in the form
  - If **Ghost** is bigger it means that 50/60 Hz ghost is present: in this case compensate the AC magnetic external noise
  - If **Quad G** is bigger it means that Phase and Quadrature Offset are not calibrated correctly: in this case perform the RX Offset Calibration again
- Fill in the Quality Form with the obtained values

DC Ghost Test

This test is necessary to verify if DC magnetic fluctuations (<5 Hz) are present and still present after the DC compensation procedure.

Necessary tools

- Knee coil number 2
- Homogeneous phantom (axial position)

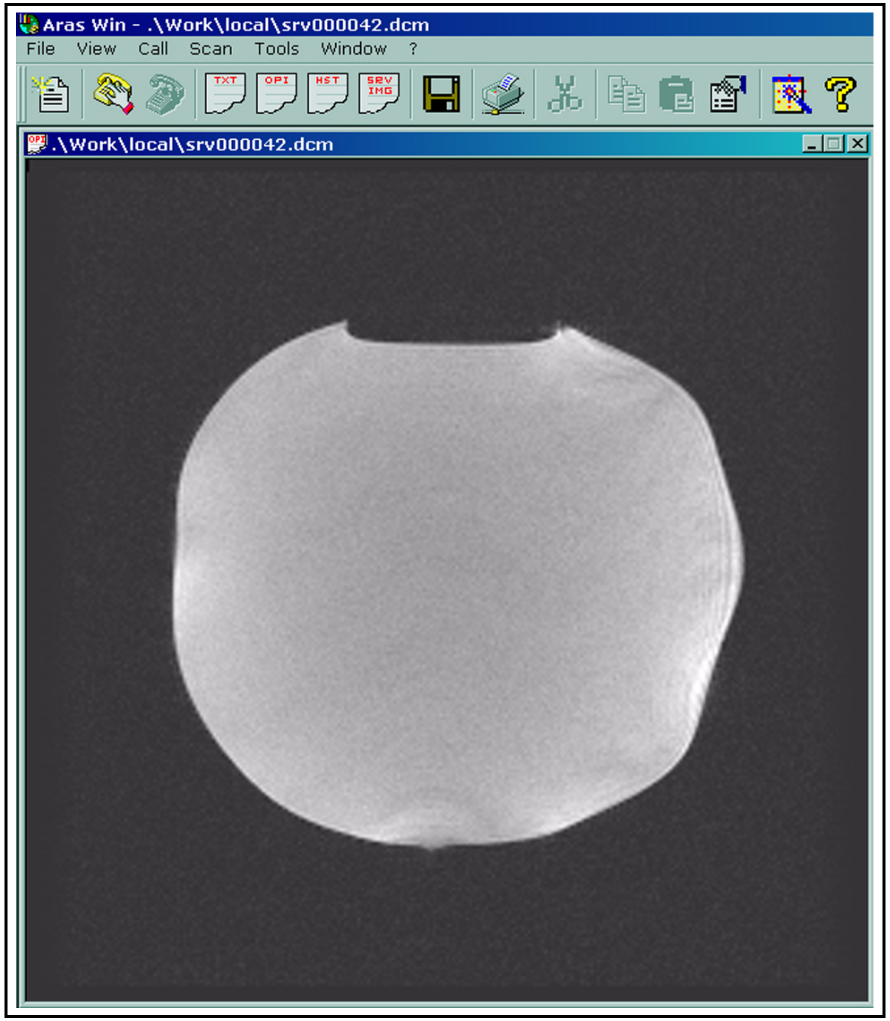
Operations

- Place the coil and insert the phantom with its support
- Under OPI Click select **<Protocol List>** then select the correct sequences following the Installation Quality Form and start them
- When the image appears check if DC ghost are present also chancing the LUT (e.g.: see the next figure)
- If the ghost is not present fill the Installation Quality Form; if it's present check and repeat the magnetic compensation procedure
- If the ghost is still present after the magnetic compensation procedure, set to **1** the **Phase Corr** flag (Internet Explorer, **DEBUG** page). In this condition some sequences are less sensitive to external DC magnetic fluctuation but some others have less signal then before

---

⚠**WARNING Set to 1 the Phase Corr flag only if really necessary!!!**

Fig. 333: Image with DC ghost (blurring)


Aras Win - .\Work\local\srv000042.dcm
File
View
Call
Scan
Tools
Window
?
TXT
OPI
HST
SRV IMG
.\Work\local\srv000042.dcm

Stability test

This test is necessary to verify if AC magnetic fluctuation (16.6-20 Hz, 50-60 Hz) or DC magnetic fluctuation (<5 Hz) are present.

Necessary tools

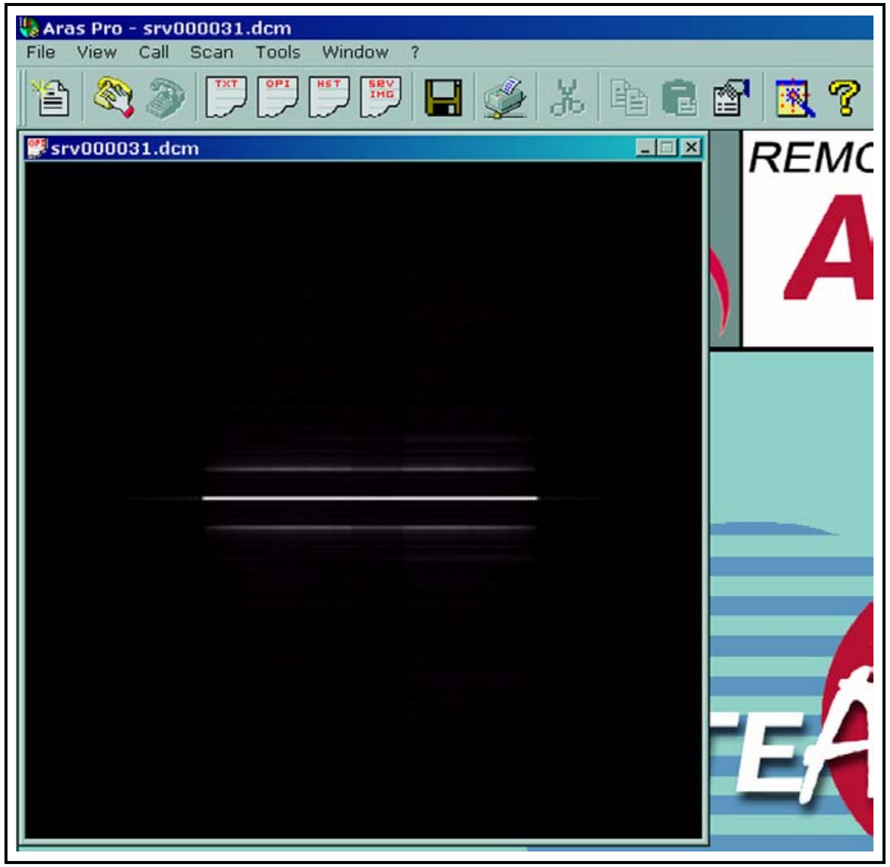
- Knee coil number 2
- Geometrical phantom and its support (axial position)

Operations

- Insert the Knee Coil 2 in Axial position with the suitable phantom in it and perform a Scout selecting the district <**Other**> and <**A**> bed patient
- Under OPI select **<Protocol List>** then select the correct sequences following the Installation Quality Form and start them
- Wait for the images to be obtained then, under ARAS, open the correct image then open the **stabilitytest.rec** file (under Internet Explorer) to read the obtained values
  - Amp. Stability lower than 3%
  - Phase Stability lower then 8°

NOTICE	After the Magnetic Compensation Procedure the thresholds have higher values: refer to the Installation Quality Form

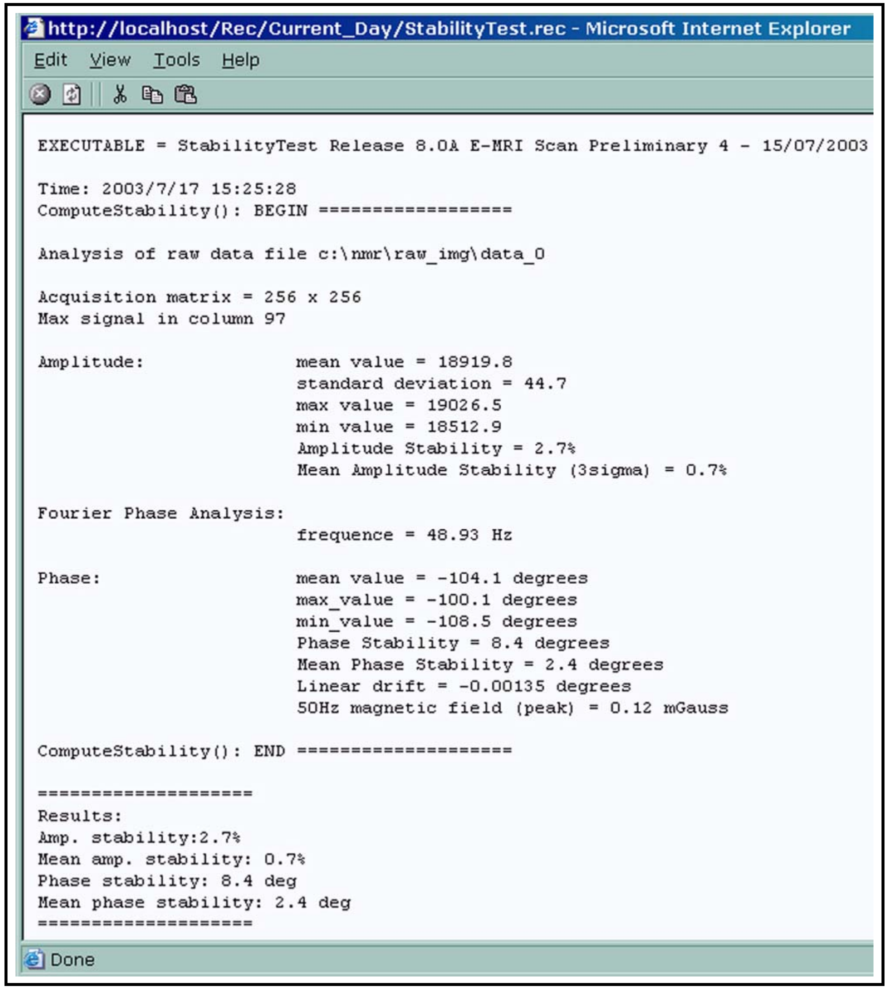
Fig. 334: Stability test



- If the values are larger with respect to the reference values written on the quality form magnetic fluctuation is not compensated or the magnetic compensation doesn't work properly. Even if the magnetic compensation procedure was correct applied but the stability DC values are out of spec, set to **1** the **Phase Corr** flag Internet Explorer, **DEBUG** page). In this condition some sequences are less sensitive to external DC magnetic fluctuation. If enabled the Amplitude Stability values won't be applicable, if the

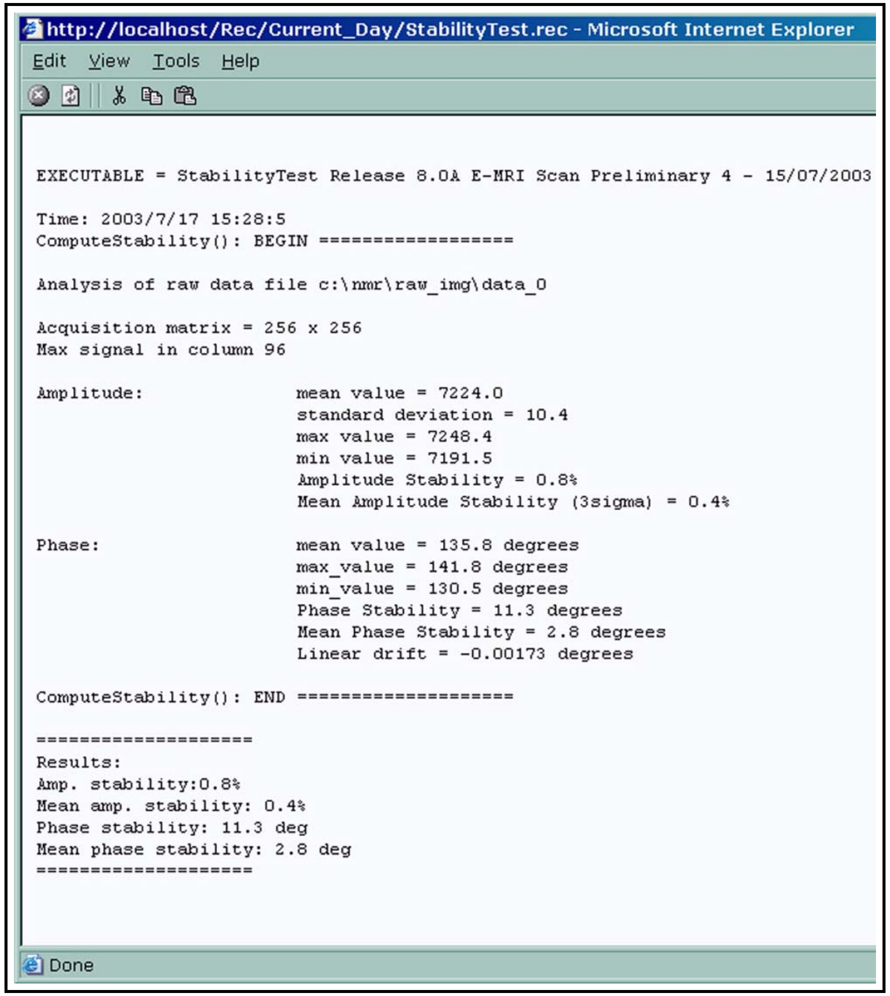
Phase Stability is still out of spec check the image quality (refer to the DC Ghost Test).

Fig. 335: AC Stability Rec File


http://localhost/Rec/Current_Day/StabilityTest.rec - Microsoft Internet Explorer
Edit View Tools Help
Done

```
EXECUTABLE = StabilityTest Release 8.0A E-MRI Scan Preliminary 4 - 15/07/2003

Time: 2003/7/17 15:25:28
ComputeStability(): BEGIN ==================

Analysis of raw data file c:\nmr\raw_img\data_0

Acquisition matrix = 256 x 256
Max signal in column 97

Amplitude:                mean value = 18919.8
                          standard deviation = 44.7
                          max value = 19026.5
                          min value = 18512.9
                          Amplitude Stability = 2.7%
                          Mean Amplitude Stability (3sigma) = 0.7%

Fourier Phase Analysis:
                          frequence = 48.93 Hz

Phase:                    mean value = -104.1 degrees
                          max_value = -100.1 degrees
                          min_value = -108.5 degrees
                          Phase Stability = 8.4 degrees
                          Mean Phase Stability = 2.4 degrees
                          Linear drift = -0.00135 degrees
                          50Hz magnetic field (peak) = 0.12 mGauss

ComputeStability(): END ====================

====================
Results:
Amp. stability:2.7%
Mean amp. stability: 0.7%
Phase stability: 8.4 deg
Mean phase stability: 2.4 deg
====================
```

Fig. 336: DC Stability Rec File


http://localhost/Rec/Current_Day/StabilityTest.rec - Microsoft Internet Explorer
Edit View Tools Help
Done

```
EXECUTABLE = StabilityTest Release 8.0A E-MRI Scan Preliminary 4 - 15/07/2003

Time: 2003/7/17 15:28:5
ComputeStability(): BEGIN ==================

Analysis of raw data file c:\nmr\raw_img\data_0

Acquisition matrix = 256 x 256
Max signal in column 96

Amplitude:                mean value = 7224.0
                          standard deviation = 10.4
                          max value = 7248.4
                          min value = 7191.5
                          Amplitude Stability = 0.8%
                          Mean Amplitude Stability (3sigma) = 0.4%

Phase:                    mean value = 135.8 degrees
                          max_value = 141.8 degrees
                          min_value = 130.5 degrees
                          Phase Stability = 11.3 degrees
                          Mean Phase Stability = 2.8 degrees
                          Linear drift = -0.00173 degrees

ComputeStability(): END ====================

====================
Results:
Amp. stability:0.8%
Mean amp. stability: 0.4%
Phase stability: 11.3 deg
Mean phase stability: 2.8 deg
====================
```

⚠**WARNING Set to 1 the Phase Corr flag only if really necessary**

Angle Function and Spatial Resolution Checks

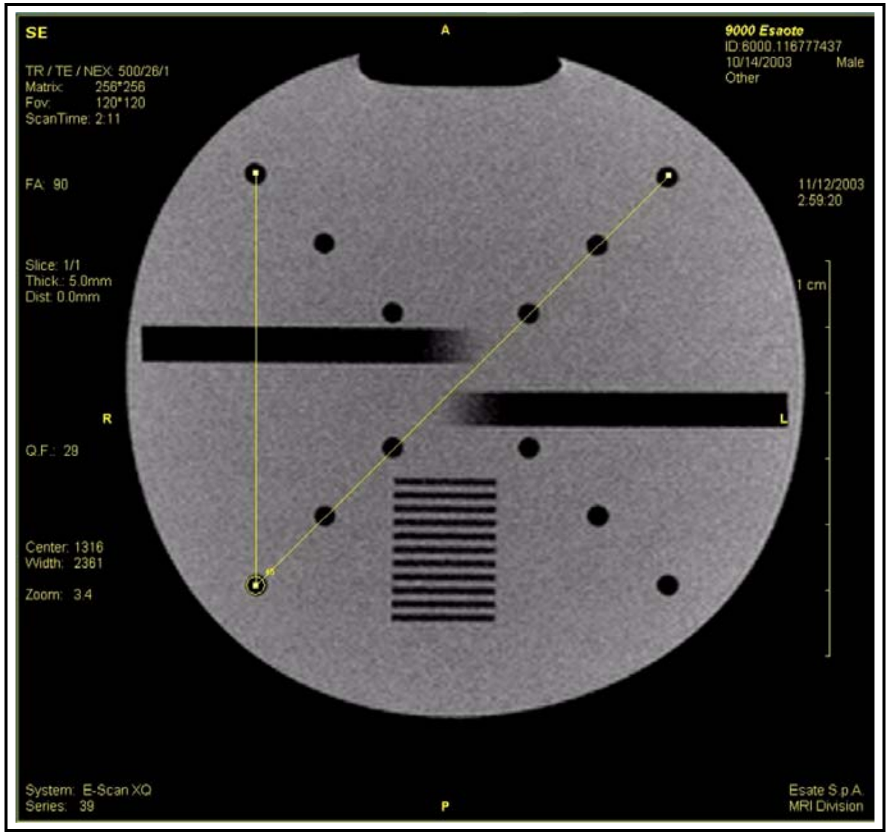
- Perform a log on as ESAMRI
- Wait for the OPI complete initialization
- Insert the Knee Coil 1 and place the Geometrical Phantom in Axial position
- Perform the following tests

Angle Function

In order to check the angle function, it is necessary to evaluate the angle between the pins of the geometrical phantom as shown in the following figure.

- Select the SE T1 sequence and open the setting window
- Check and set the sequence parameters as follows:
  - – TE = 26 ms
  - – TR = 500 ms
  - – Number of slices = 1
  - – Slice thickness = 5 mm
  - – Average = 1
  - – FOV = 120 x 120 mm
  - – Data acquisition matrix = 128 x 128
- Acquire the image
- Select **<Angle>** icon, click the left mouse button, move the mouse and draw the first segment till to the angle vertex
- Click the left mouse button and move the mouse from the vertex, drawing the second segment
- Record the angle value on the Installation and Quality Form

Fig. 337: angle Funcition Measurement



SE
TR / TE / NEX: 500/26/1
Matrix: 256*256
Fov: 120*120
ScanTime: 2:11
FA: 90
Slice: 1/1
Thick.: 5.0mm
Dist: 0.0mm
Q.F.: 28
Center: 1316
Width: 2361
Zoom: 3.4
System: E-Scan XQ
Series: 39

9000 Esaote
ID:6000.116777437
10/14/2003 Male
Other
11/12/2003
2:59:20
Esate S.p.A.
MRI Division

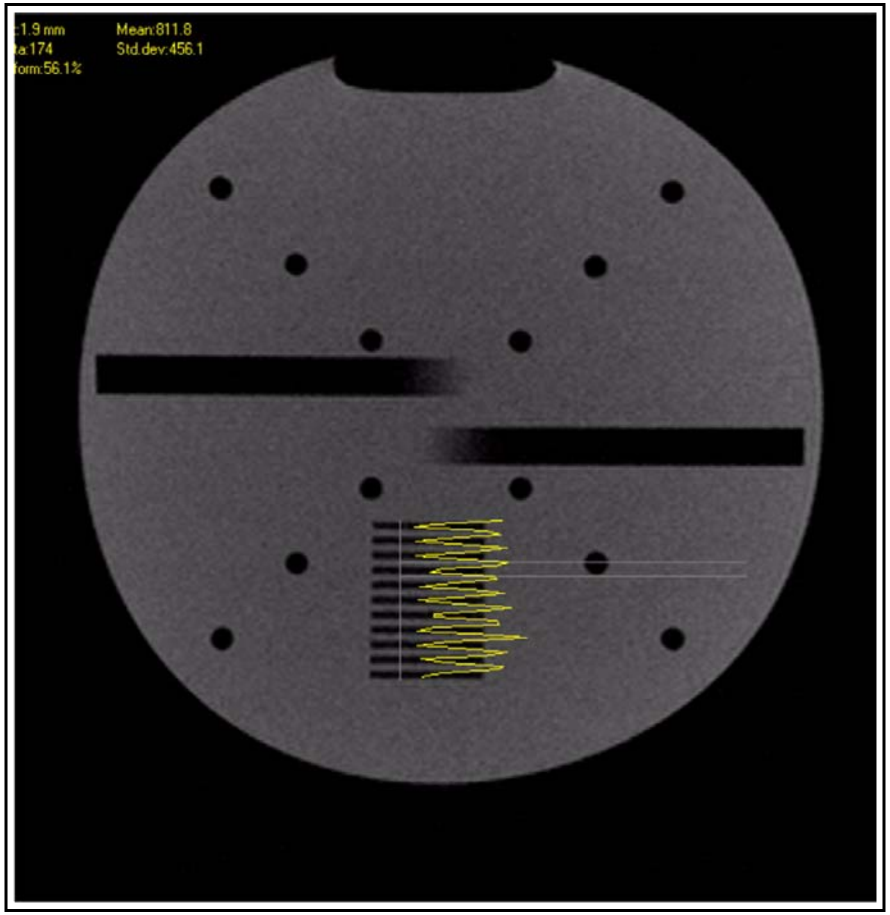
Spatial Resolution

In order to check the spatial resolution it is necessary to evaluate the intensity profile of the periodic pattern contained in the geometrical phantom, consisting of 11 parallel plates, thickness 1 mm. The distance d between the plates is equal to their thickness.

The MR signal produced by the periodic pattern must clearly show the ability of the system to distinguish each structure of the periodic pattern and in particular the signal intensity profile of the periodic pattern must exhibit the same period of the pattern itself, i.e. 2 d.

- Select the SE T1 sequence and open the setting window
- Check and set the sequence parameters as follows:
  - – TE = 26 ms
  - – TR = 500 ms
  - – Number of slices = 1
  - – Slice thickness = 5 mm
  - – Average = 1
  - – FOV = 120 x 120 mm
  - – Data acquisition matrix = 128 x 128
- Acquire the image
- Select **<Profile>** function and draw the profile in vertical direction between the two external plates of the periodic pattern and check that the profile formed by the periodic pattern is parallel to the image edges so that distances can be measured perfectly as shown in the following figure
- Verify that the intensity profile shows a periodic structure (as shown in the next figure)
- Click on the keyboard command CRTL and on the left mouse button, place the cross cursor on one of the two profile edge, then move the mouse while holding down the button: the edge will be moved accordingly along the profile
- Place the first edge in a maximum of the profile and the second edge in the successive maximum and record the Dist. parameter on the Installation and Quality Form

Fig. 338: spatial Resolution Measurement



Part 9 Installation Quality Form

Introduction

In this chapter you will find the Installation Quality Form.

The quality form compiled in the factory and containing all the System data is placed on the console inside a plastic envelope.

Refer to the Tune-up chapter for all calibration explanations.

CALIBRATION & QUALITY FORM

Installation Date	
System (console)	S/N
Magnetic unit	S/N
Large Shoulder Coil Nr.1	S/N
Knee Coil Nr.2	S/N
Wrist Coil Nr.3	S/N
Ankle Coil Nr.4	S/N
Regular Shoulder Coil Nr.5	S/N
Flex Coil Nr.6	S/N
Filters plate	S/N
Shielding Box	S/N
Software Release	
Site Address	
Site Phone Number	
Site Modem Phone Number	
Customer	
Contact person	
INSTALLED by	Signature

General parameters

Crate Checks (Installation only)

	Site		References
No defects due to mechanical shocks			OK

Outside Marking (Installation only)

	Site		References
Name and address of manufacturer			OK
Product part number and serial number			OK

Cable Connection Checks (Installation only)

	Site		References
Tightness of terminal screws of the protective earth connection between the magnetic unit and the filter panel			OK
Tightness of terminal screws of the protective earth connection between the electronics box and the PC unit			OK
Setting and tightness of connectors			OK
Tightness of fastening screws of each electronic module			OK

Shielding Box (Installation only)

	Site		References
Attenuation			> 70 dB

System (console)	S/N

Mechanical Test

Patient table (Installation only)

	Site		References
Rotation and Translation			OK
Wheels brake			OK
Padding			OK

RF Coils System

	Factory	Site		References
Coil rotation mechanism				OK
Cables extension mechanism				OK

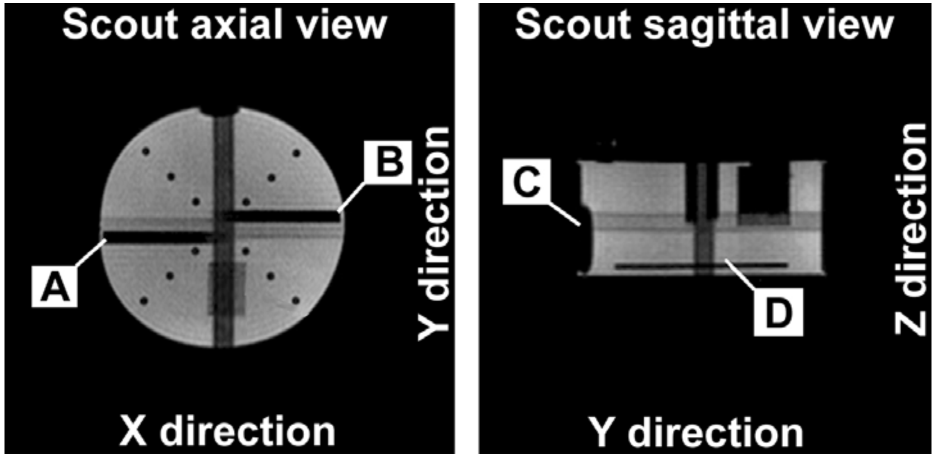
Covers Set (Installation only)

	Site		References
Magnetic unit covers			OK
Console covers			OK
Patient table covers			OK

System (console)	S/N

Gradient Orientation Check

Fig. 339: Gradient orientation test (from the left side: axial and sagittal view) A and B = rectangular septum; C = air bubble and D = rectangular septum



Geometrical phantom, sequence SCOUT, Axial position, districts = OTHER, plastic screw up and on the bedside (right): (A) position

	Site		References
Transverse (A and B)			OK
Sagittal (C and D)			OK

B0 coil (4th channel)

Spherical Phantom 86 mm (910 2242 000), sequence SCOUT, Axial position

	Factory	Site		References
Versus				OK

System (console)	S/N

Calibrations

Geometrical phantom - Knee Coil

	Factory		Site			References
Channel1: Scout Gain 1 / Gain 2 (coil 2 - Geometrical phantom 910 1165 000)						200 ÷ 255 / 0 ÷ 10
Channel 2: Scout Gain 1 / Gain 2 (coil 2 - Geometrical phantom 910 1165 000)						200 ÷ 255 / 0 ÷ 50
Frequency (idem)						7.3 ÷ 8.0 MHz
offset X (coil 2 - Spherical phantom 910 2242 000)						-2000 ÷ 2000
offset Y (idem)						-2000 ÷ 2000
offset Z (idem)						-2000 ÷ 2000
Average fft (coil 1 -phantom 910 2180 000)						Max. 800

Channel Delay - Hardware connection using the provided BNC cables and adapters

	Factory	Site		References
Channel Delay				±60°

TX Coil Check

	Factory	References		Site	References
Tuning		F0 ± 2 kHz			F0 ± 5 kHz
Matching		> 25 dB			> 20 dB

F0 = Magnet Central Frequency

System (console)	S/N

Thermal Stability

	Factory	**Site**		**References**
Room Temperature				20° ÷ 26°
Up inner Temp. - mean				Max. ± 40 m °C
Up inner Temp.- deviation (pk-pk)				Max. 3 m °C
Up outer Temp. - mean				Max. ± 40 m °C
Up outer Temp.- deviation (pk-pk)				Max. 3 m °C
Down inner Temp. - mean				Max. ± 40 m °C
Down inner Temp.- dev. (pk-pk)				Max. 3 m °C
Down outer Temp. - mean				Max. ± 40 m °C
Down outer Temp.- dev. (pk-pk)				Max. 3 m °C
Up inner Power - mean				Max. 40 W
Up inner Power - dev. (pk-pk)				Max. 4 W
Up outer Power - mean				Max. 20 W
Up outer Power - dev. (pk-pk)				Max. 4 W
Down inner Power - mean				Max. 40 W
Down inner Power-dev.(pk-pk)				Max. 4 W
Down outer Power - mean				Max. 20 W
Down outer Power-dev.(pk-pk)				Max. 4 W

System (console)	S/N

Gradient Tuning

GRA Regulators - Spherical Phantom 86 mm (910 2242 000)

	Factory	**Site**		**References**
X Gradient				5% ± 0.2
Y Gradient				5% ± 0.2
Z Gradient				5% ± 0.2
4th Channel				< 1.5

Eddy Current Compensation - Spherical Phantom 86 mm (910 2242 000)

	Factory	**Site**		**References**
X Gradient (*)				< 1%
X B0 (*)				< 0.35 μT/mT/m
Y Gradient (*)				< 1%
Y B0 (*)				< 0.35 μT/mT/m
Z Gradient (*)				< 1%
Z B0 (*)				< 0.35 μT/mT/m

(*) Report the maximum value among the three temporal ranges of the measure

Gradient Delay - Ghost Phantom 25 ml (810 6246 000)

	Factory	**Site**		**References**
X Gradient				10 ÷100 μs
Y Gradient				10 ÷100 μs
Z Gradient				10 ÷100 μs

System (console)	S/N

Linear Gain Adjusting

Coil 2 - Knee, Geometrical phantom (910 1165 000)

Sequence 4a_GRX_GAIN - Axial position - Vertical measurement

	Factory	**Site**		**References**
Vertical 40 mm				39.5÷40.5
Vertical 60 mm				59.5÷60.5
GRA gain X				

Sequence 4b_GRY_GAIN - Axial position - Vertical measurement

	Factory	**Site**		**References**
Vertical 40 mm				39.5÷40.5
Vertical 60 mm				59.5÷60.5
GRA gain Y				

Sequence 4c_GRZ_GAIN - Coronal position - Horizontal measurement

	Factory	**Site**		**References**
Horizontal 40 mm				39.5÷40.5
Horizontal 60 mm				59.5÷60.5
GRA gain Z				

System (console)	S/N

Shimming Verification (*)

Coil 2 - Knee - Shimming phantom

	Site, I measure	References	Site, II measure
FWHM / 140 mm DSV		< 4 ppm	
(2 0) cos			
(2 1) cos			
(2 1) sin			
(2 2) cos			
(2 2) sin			

(*) Note: this test has to be performed with the shimming phantom according to the Shim check procedure in the Service Manual and Installation Manual; if the procedure output is “Note: static magnetic field homogeneity out of specification (FWHM > 4 ppm on DSV 140 mm). Proceed with second order harmonic coefficient adjustment”, a site shimming refinement and a second measurement afterwards are needed, also following the procedure. The results to be written in the upper table are in the file SHIM_HIST.REC, which is readable in OPI (Service -> HD rec File -> Rec File View -> file name: shim_hist.rec). If no site shimming is necessary, only the column “Site, I measure” shall be filled.

Sequences Calibration

Geometrical phantom, Coil 2 - Knee

	Factory	Site		References
TSE - 1st echo - G slice				-7000 ± 6000
TSE - 2nd echo - G slice				5000 ± 6000
TSE - 3rd echo - G slice				5000 ± 6000
TME - 1st echo - G slice				8000 ± 6000
TME - 2nd echo - G slice				5000 ± 6000
TME - 3rd echo - G slice				5000 ± 6000

System (console)	S/N

Coil Parameters

Coil 1 Shoulder - Spherical phantom 140 mm (910 2180 000)

	Factory	References		Site	References
Varicap 1		35÷85			14÷142
Gain RF 180		≤ 210			≤ 215
Automatic coil recognition		OK			OK

Coil 2 Knee - Spherical phantom 140 mm (910 2180 000)

	Factory	References		Site	References
Varicap 1		35÷85			14÷142
Varicap 2		35÷85			14÷142
Gain RF 180		≤ 220			≤ 225
Automatic coil recognition		OK			OK

Coil 3 Hand & Wrist - Homogeneous phantom 74 mm (910 1041 000)

	Factory	References		Site	References
Varicap 1		35÷85			14÷142
Varicap 2		35÷85			14÷142
Gain RF 180		≤ 230			≤ 235
Automatic coil recognition		OK			OK

System (console)	S/N

Coil 4 Foot & Ankle - Homogeneous phantom 74 mm (910 1041 000)

	Factory	**References**		**Site**	**References**
Varicap 1		35÷85			14÷142
Varicap 2		35÷85			14÷142
Gain RF 180		≤ 230			≤ 235
Automatic coil recognition		OK			OK

Coil 5 Shoulder - Homogeneous phantom 74 mm (910 1041 000)

	Factory	**References**		**Site**	**References**
Varicap 1		35÷85			14÷142
Gain RF 180		≤ 210			≤ 205
Automatic coil recognition		OK			OK

Coil 6 Flex - Spherical phantom 140 mm (910 2180 000)

	Factory	**References**		**Site**	**References**
Varicap 1		35÷85			14÷142
Gain RF 180		≤ 210			≤ 205
Automatic coil recognition		OK			OK

System (console)	S/N

Stability Measurements

Coil 2 Knee - Geometrical Phantom (910 1165 000) -Transverse position

Stability AC 50 (SE with TE at 20 msec) or 60 Hz (SE with TE at 16 msec)

	Factory	**Site**		**References**
Amplitude Stability Before AC comp.				≤ 3%
Phase Stability Before AC compensation				≤ 4° (*)
Amplitude Stability After AC comp.				≤ 5%
Phase Stability After AC compensation				≤ 6° (*)

Stability AC 16.6 Hz (SE with TE at 60 msec) - (*) Phase stability refers to “Mean Phase Stability”

	Factory	**Site**		**References**
Amplitude Stability Before AC comp.				≤ 3%
Phase Stability Before AC compensation				≤ 4° (*)
Amplitude Stability After AC comp.				≤ 5%
Phase Stability After AC compensation				≤ 6° (*)

System (console)	S/N

Ghosting Measurement

Ghosting AC 50 or 60 Hz - Coil 2 Knee - Ghosting phantom 25 ml (810 6246 000)

	Factory	Site		References
Quadrature Ghosting				≤ 2%
Phase Ghosting Before AC comp.				≤ 2%
Phase Ghosting After AC comp.				≤ 2%

Ghosting DC - Coil 2 Knee - Spherical Phantom 86 mm (910 2242 000)

	Factory	Site		References
Phase Ghosting Before DC comp.				No visible ghosting (also changing the window)
Phase Ghosting After DC comp.				No visible ghosting (also changing the window)

Stability DC (GE) - (*) Not applicable in case of “Phase Corr” flag set to 1

	Factory	Site		References
Amplitude Stability Before DC comp. (*)				≤ 3%
Phase Stability Before DC compensation				≤ 8° (Max Phase Stab.)
Amplitude Stability After DC comp. (*)				≤ 5%
Phase Stability After DC compensation				≤ 12° (Max Phase Stab.)

System (console)	S/N

Uniformity measurements

Coil 2 - Knee - Spherical Phantom 140 mm (910 2180 000)

	Factory	Site		References
Axial				< 30%

SNR measurements

Coil 2 - Knee - Spherical Phantom 140 mm Spin Echo

		Factory	Site		References
Axial	SNR				> 48
	Sigma				< 10% SNR
Sagittal	SNR				> 48
	Sigma				< 10% SNR
Coronal	SNR				> 48
	Sigma				< 10% SNR

Gradient Echo

		Factory	Site		References
Axial	SNR				> 35
	Sigma				< 10% SNR
Sagittal	SNR				> 35
	Sigma				< 10% SNR
Coronal	SNR				> 35
	Sigma				< 10% SNR

System (console)	S/N

Coil 1 - Shoulder - Spherical Phantom 140 mm (910 2180 000) Spin Echo

		Factory	Site		References
Axial	SNR				> 34
	Sigma				< 10% SNR

Coil 3 - Hand/Wrist - Homogeneous phantom 74 mm (910 1041 000) Spin Echo

		Factory	Site		References
Axial	SNR				> 110
	Sigma				< 10% SNR

Coil 4 - Foot/Ankle - Homogeneous phantom 74 mm (910 1041 000) Spin Echo

		Factory	Site		References
Axial	SNR				> 90
	Sigma				< 10% SNR

Coil 5 - Shoulder - Homogeneous phantom 74 mm (910 1041 000) Spin Echo

		Factory	Site		References
Axial	SNR				> 60
	Sigma				< 10% SNR

Coil 6 - Flex - Homogeneous phantom 140 mm (910 2180 000) Spin Echo

		Factory	Site		References
Axial	SNR				> 23
	Sigma				< 2.5% SNR

System (console)	S/N

USER INTERFACE

Data Processing (Installation Only)

Coil 2 - Knee - Spherical Phantom 140 mm (910 2180 000)

	Site		**References**
Create a new patient			OK
Execute the scans contained in Protocols - Knee			OK
Check MPR function			OK
Check Zoom function			OK
Check LUT function			OK
Check measure functions			OK
Check statistical functions			OK
Check exporting and retrieving of Patient/Study both on OD and CD			OK
Submit the unit to casual one hour test			OK

Spatial Resolution (Installation Only)

Coil 2 - Knee, Geometrical phantom (910 1165 000) - Dedicated Sequence (refer to the Quality Assurance chapter) - Axial position

	Site		**References**
Distance between two successive maximum values			2 ± 10% mm

Angle Function (Installation Only)

Coil 2 - Knee, Geometrical phantom (910 1165 000) - Dedicated Sequence (refer to the Quality Assurance chapter) - Axial position

	Site		**References**
Angle Function			45× ± 5%

System (console)	S/N

Imaging Stop (Installation Only)

	Site		References
Test 1			OK
Test 2			OK

ELECTRICAL SAFETY

Protective earth resistance (Installation Only)

	Site		References
Between the protective earth conductor of the three-wire power supply cable and the gantry metallic profile			0.2 ohm
Between the protective earth conductor of the three-wire power supply cable and the PC fan protection (rear side)			0.2 ohm
Between the protective earth conductor of the three-wire power supply cable and the PC connectors (rear side)			0.2 ohm

Leakage current (Installation Only)

	Site		References
Earth leakage current in normal condition (N.C.)			5 mA
Earth leakage current in Single Fault Condition (S.F.C.)			10 mA
Patient leakage current in normal condition (N.C.)			0.1 mA

System (console)	S/N

Part 10 System Backup

Introduction

This function allows the creation of a copy of the system calibration data and user's protocols and configurations, but does not save the customer's images. To save them insert an empty optical cartridge and use the **<Image Backup>** feature present under the **<Tools>** button located in the ARAS Program toolbar. Use **<Image Restore>** feature to copy the images from the Backup cartridge to the System HD.

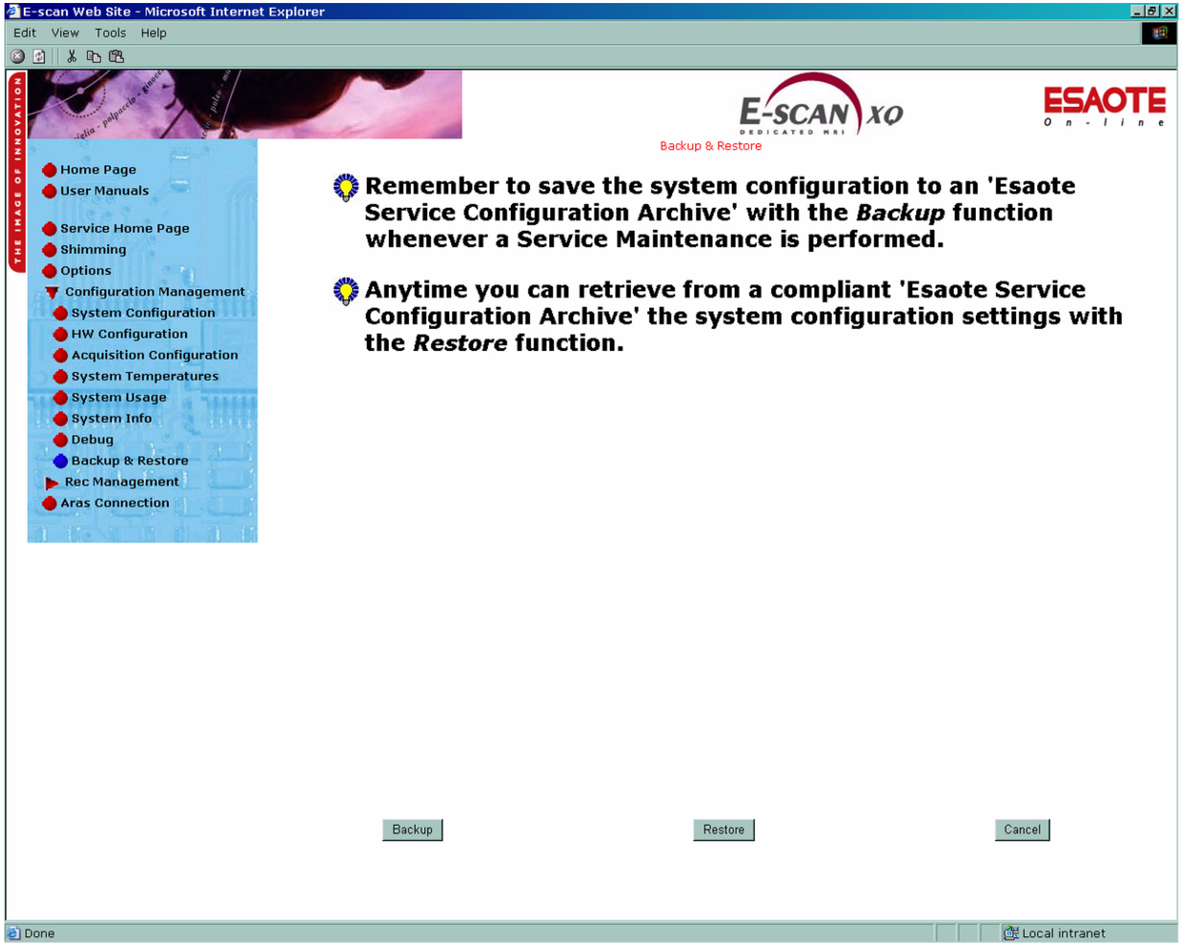
NOTICE	It's not possible to use the same optical cartridge to archive the Customer's images and the Service images

Perform the System Back-up at the end of theSystem Installation and during the evry maintenance.

Procedure

- Log on the system like SERV (typing the correct password) and launch Internet Explorer
- Insert a optical cartridge into the ODD 3½
- From the homepage, select **Configuration Management** then **Backup & Restore** (like shown in the next figure)
- Follow the SW indications

Fig. 340: Backup page



Remember to save the system configuration to an 'Esaote Service Configuration Archive' with the *Backup* function whenever a Service Maintenance is performed.

Anytime you can retrieve from a compliant 'Esaote Service Configuration Archive' the system configuration settings with the *Restore* function.

This page allows creating a system backup and to restore from the created optical cartridge.

Part 11 Peripheral Settings

Introduction

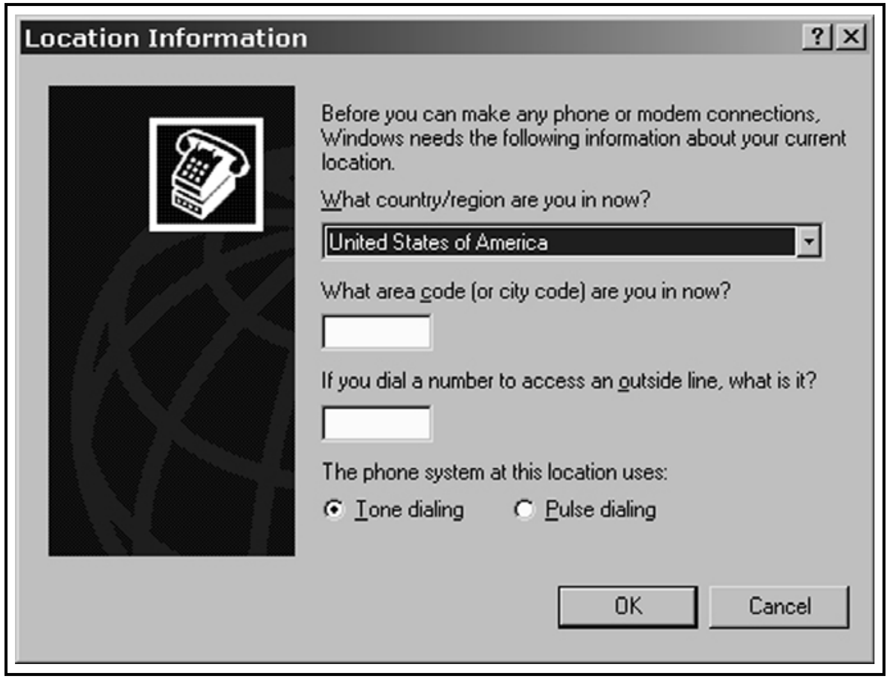
This chapter describes how to set the System Modem in order to accept the Service Remote Assistance incoming connections and how to install a generic windows printer.

Modem Settings For Service Remote Assistance

For the complete explanation refer to the User's Guide, chapter 22 titled **“User and administrator access to the network”**. For the **“Modem configuration for remote technical assistance operations”** follow these steps:

- Perform the log on like ADMIN then select Start, Settings, Network and Dial-up Connection. Make **New Connection** from the Windows, start menu. The following **Location Information** dialogue window will appear on the screen

Fig. 341: Location Information Window



Before you can make any phone or modem connections, Windows needs the following information about your current location.

What country/region are you in now? United States of America

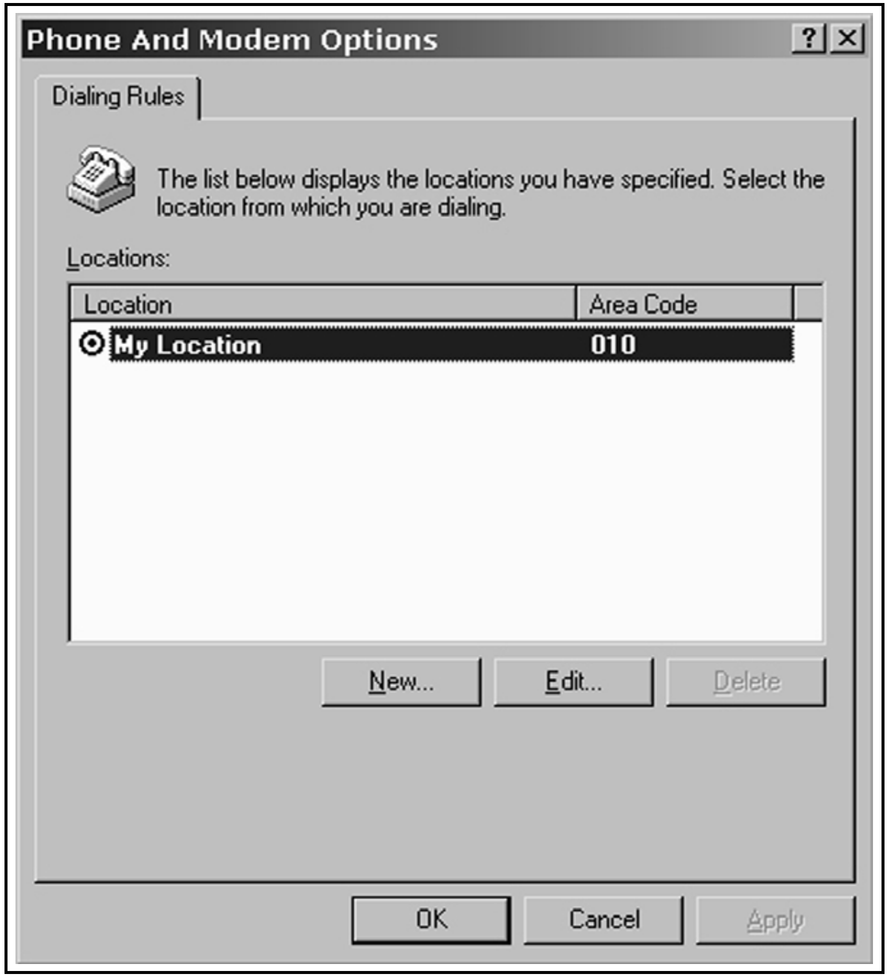
What area code (or city code) are you in now?

If you dial a number to access an outside line, what is it?

The phone system at this location uses: ● Tone dialing ○ Pulse dialing

- Fill in every field of the **Location Information** window. Define the current location of the system, i.e. the State in which the system is currently located, the code number of the town, the number which shall be dialed to access the external line and the type of signal in use (the tone or pulse dialing). Press **Ok** to continue the procedure with the parameters you have entered and to display the following window. Otherwise, press **Cancel** to abandon the procedure

Fig. 342: ***Phone and Modem Options*** *window*



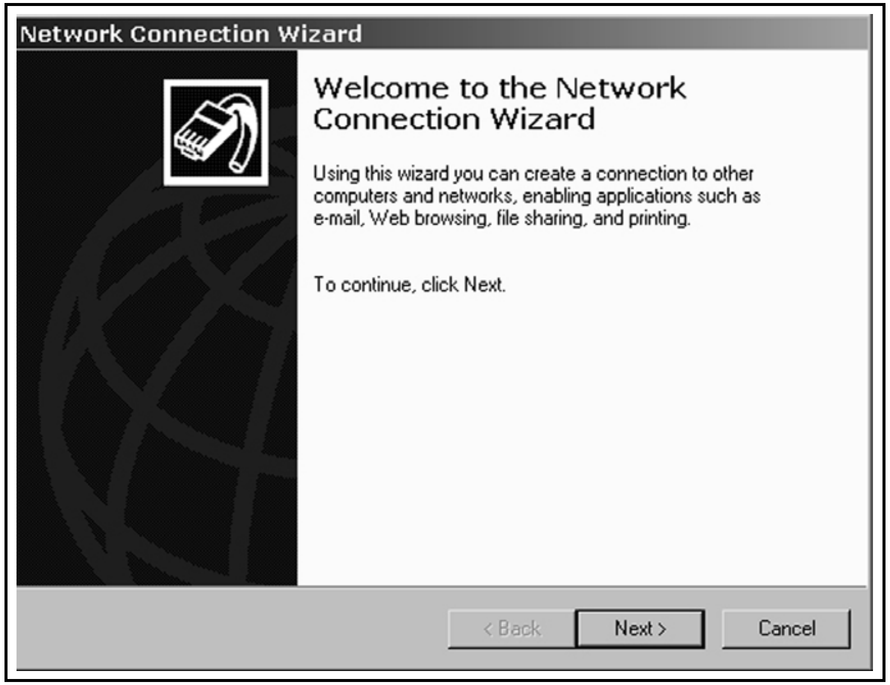
The list below displays the locations you have specified. Select the location from which you are dialing.

Locations:

Location	Area Code
⦿ My Location	010

- The **Phone and Modem Options** window will display a list including the location/s you have entered. Select the current one and press **Ok**. The following **Network Connection Wizard** window will appear on the screen. Press **Cancel** to abandon the procedure in progress. The **New, Edit** and **Delete** function keys will respectively enable you to create a new location, to change the parameters you have entered before for the selected location and to delete the selected location

Fig. 343: ***Welcome to the Network Connection Wizard*** *window*



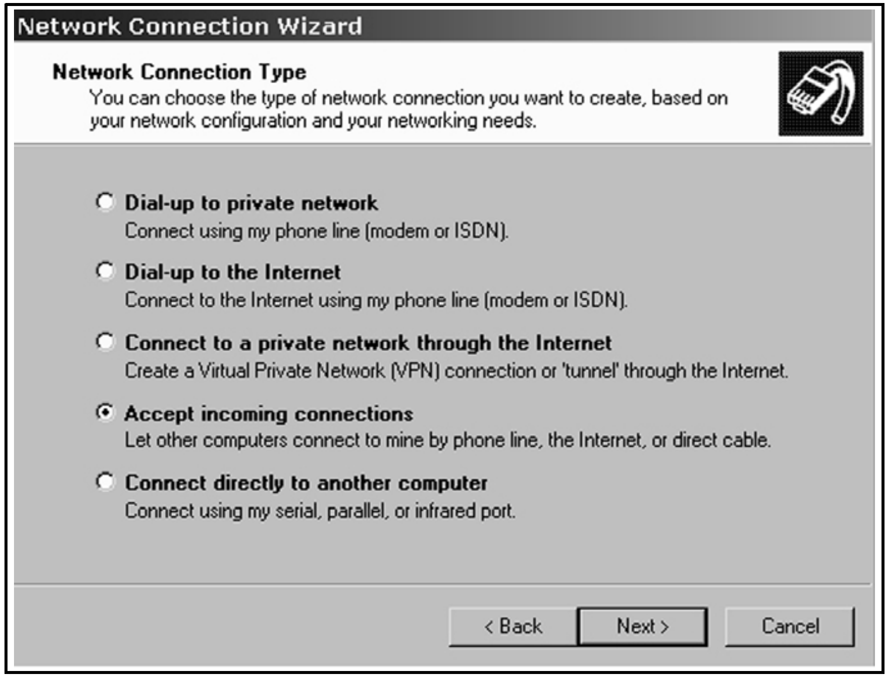
Welcome to the Network Connection Wizard

Using this wizard you can create a connection to other computers and networks, enabling applications such as e-mail, Web browsing, file sharing, and printing.

To continue, click Next.

- From the **Welcome to the Network Connection Wizard** window press the **Next** key to establish a connection with other computers or networks. The following window will appear on the screen. Press **Cancel** to abandon the configuration procedure

Fig. 344: ***Network Connection Type*** *window*



Network Connection Wizard

Network Connection Type

You can choose the type of network connection you want to create, based on your network configuration and your networking needs.

○ **Dial-up to private network**
Connect using my phone line (modem or ISDN).

○ **Dial-up to the Internet**
Connect to the Internet using my phone line (modem or ISDN).

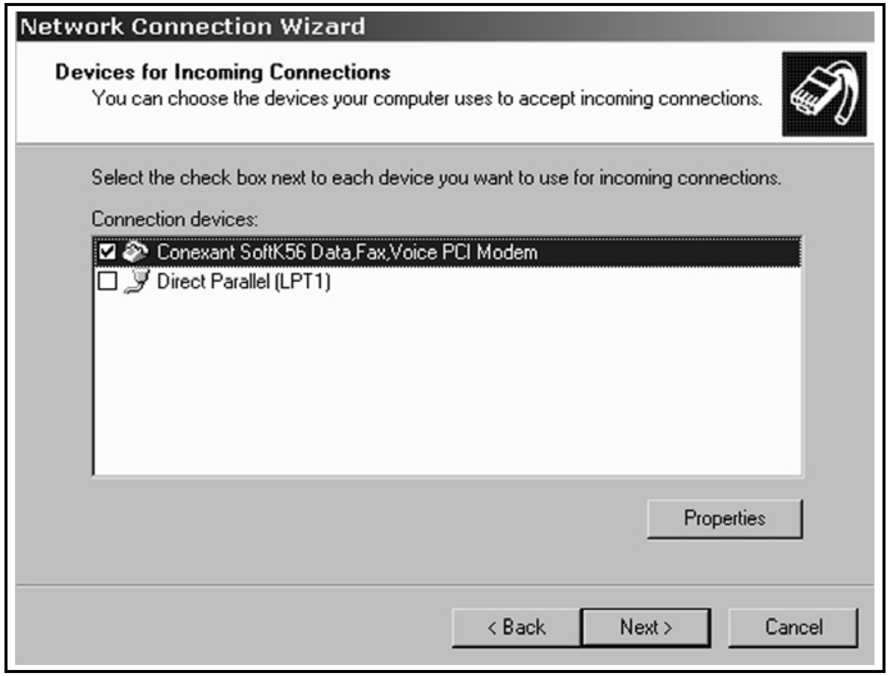
○ **Connect to a private network through the Internet**
Create a Virtual Private Network (VPN) connection or 'tunnel' through the Internet.

● **Accept incoming connections**
Let other computers connect to mine by phone line, the Internet, or direct cable.

○ **Connect directly to another computer**
Connect using my serial, parallel, or infrared port.

- From the Network Connection Type window select the type of network connection you wish to establish. To select the Accept incoming connections field, press the left mouse key to click the small ball next to it. This will enable any other PC to connect with the Artoscan C system by means of a phone line, Internet or a direct cable
- From the same window select the Next button to continue the procedure and access the following window. Select Back to go back to the previous window or Cancel to exit from the Network Connection Wizard window

Fig. 345: ***Devices for Incoming Connections*** *window*



Network Connection Wizard

Devices for Incoming Connections

You can choose the devices your computer uses to accept incoming connections.

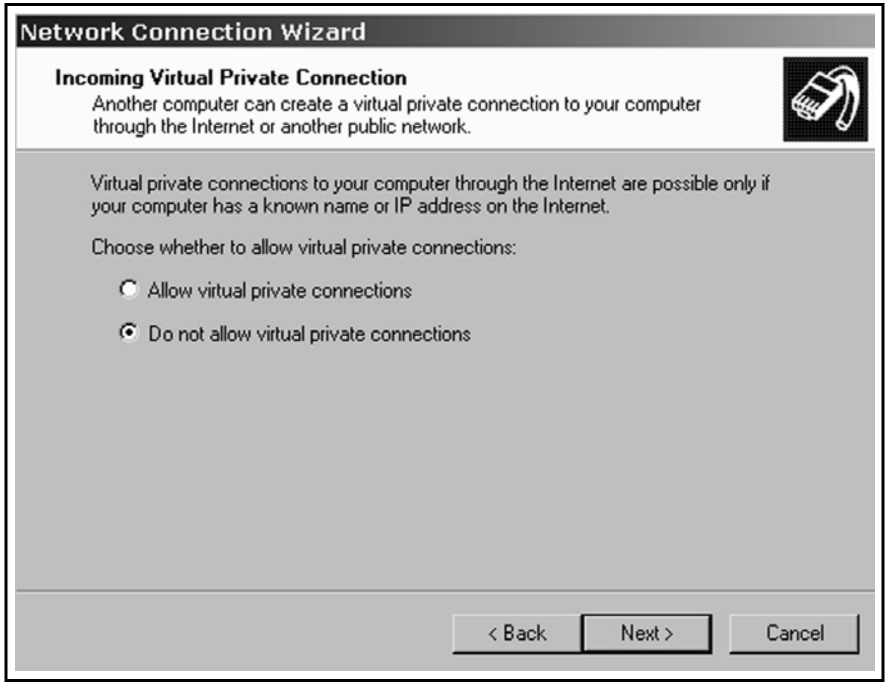
Select the check box next to each device you want to use for incoming connections.

Connection devices:

☑ Conexant SoftK56 Data,Fax,Voice PCI Modem
☐ Direct Parallel (LPT1)

- Select the Connexant Soft K56 Data, Fax, Voice PCI Modem device (a modem version taken as an example) which is intended to receive the external connections to the system, press the left mouse key to click the “cyclic” box next to it. If the “cyclic” box is white, it means that the corresponding field is “off”, i.e. that device is not enabled to receive. If the v symbol appears on the screen, it means that the field is “on”, i.e. that device is enabled to receive. Click the left mouse key to select first a device from the list and the Properties control. The relating properties will appear on the screen. From the same window select the Next control to continue the procedure and access the following window. Select Back to go back to the previous window or Cancel to exit from the Network Connection Wizard window

Fig. 346: Incoming Virtual Private Connection window



Network Connection Wizard

Incoming Virtual Private Connection

Another computer can create a virtual private connection to your computer through the Internet or another public network.

Virtual private connections to your computer through the Internet are possible only if your computer has a known name or IP address on the Internet.

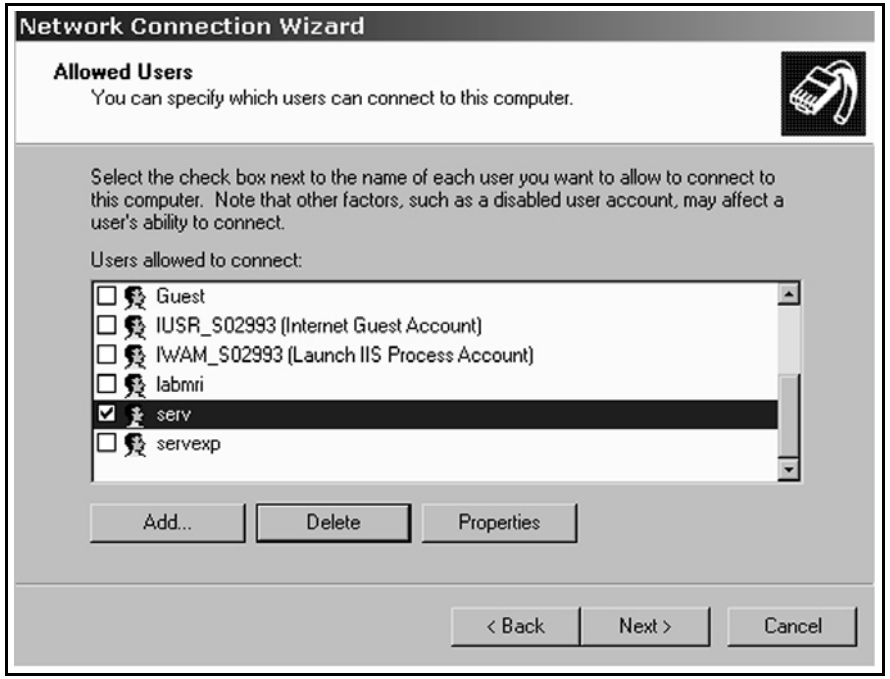
Choose whether to allow virtual private connections:

○ Allow virtual private connections

● Do not allow virtual private connections

- The Incoming Virtual Private Connection window will allow the user to enable an option which will in its turn allow another computer to establish a private virtual connection with the Artoscan C system via Internet or by means of another public network. This window will include two selectable fields to enable or disable this option. The network administrator is strongly recommended to click the left mouse key to select the Do not allow virtual private connections field which will prevent the user from establishing any private connection. From the same window select the Next control to continue the procedure and access the following window. Select Back to go back to the previous window or Cancel to exit from the Network Connection Wizard window

Fig. 347: Allowed Users window



Network Connection Wizard

Allowed Users

You can specify which users can connect to this computer.

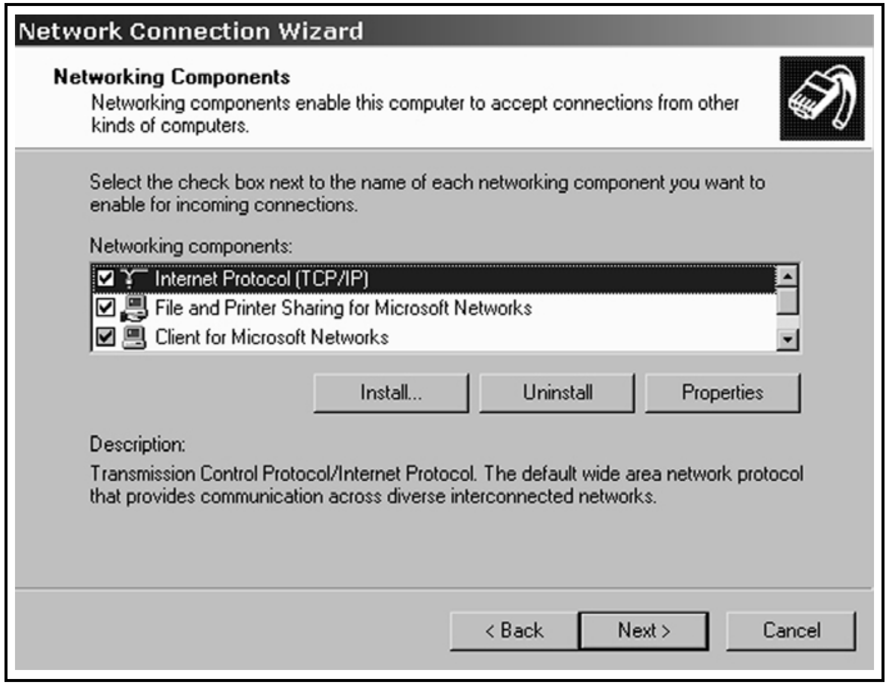
Select the check box next to the name of each user you want to allow to connect to this computer. Note that other factors, such as a disabled user account, may affect a user's ability to connect.

Users allowed to connect:

☐ Guest
☐ IUSR_S02993 (Internet Guest Account)
☐ IWAM_S02993 (Launch IIS Process Account)
☐ labmri
☑ serv
☐ servexp

- From the list of the Allowed Users window select the external user you wish to enable for the connection to the system. Select the serv option, i.e. the only user who may provide for remote technical assistance, press the left mouse key to click the “cyclic” box next to it. If the “cyclic” box is white, it means that the corresponding field is “off”, i.e. that user is not enabled to connect via modem. If the v symbol appears on the screen, it means that the field is “on”, i.e. that user is enabled to connect via modem. Press the Add, Delete and Properties function keys to add a user to the already existing list, to delete the selected user from the list and to display the relating properties. From the same window select the Next control to continue the procedure and access the following window

Fig. 348: Networking Components window


Network Connection Wizard

Networking Components

Networking components enable this computer to accept connections from other kinds of computers.

Select the check box next to the name of each networking component you want to enable for incoming connections.

Networking components:

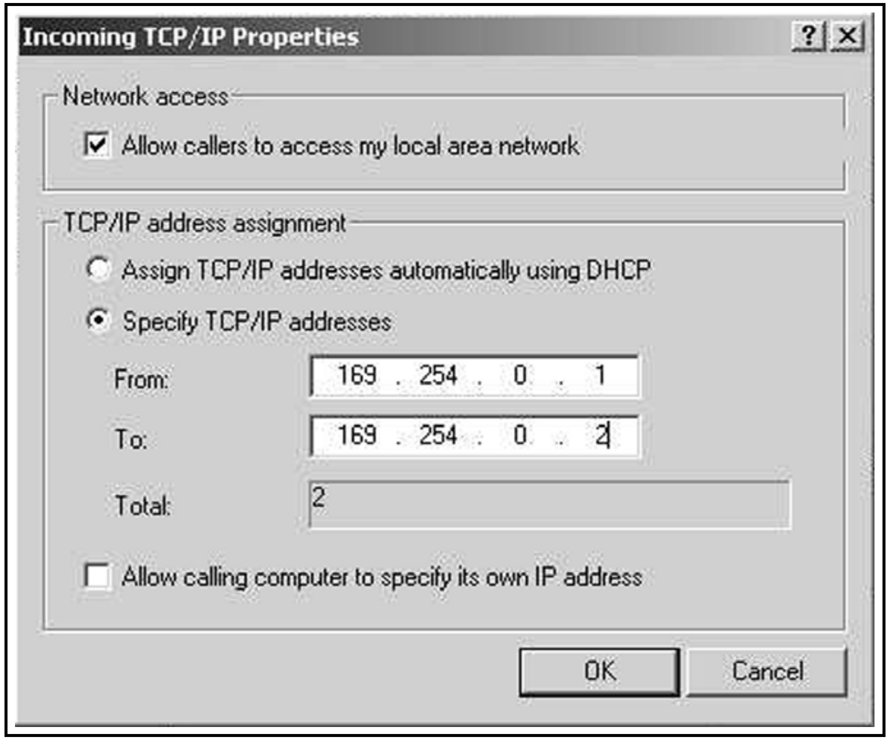
☑ Internet Protocol (TCP/IP)
☑ File and Printer Sharing for Microsoft Networks
☑ Client for Microsoft Networks

Description:

Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

- From the previous figure select the Internet Protocol TCP/IP properties and a new window will appear. Now check the Allow Incoming Connection box and set the following TCP/IP addresses: from 169.254.0.1, to 169.254.0.2 like shown in the following figure

Fig. 349: Incoming TCP/IP Properties window


Incoming TCP/IP Properties

Network access

☑ Allow callers to access my local area network

TCP/IP address assignment

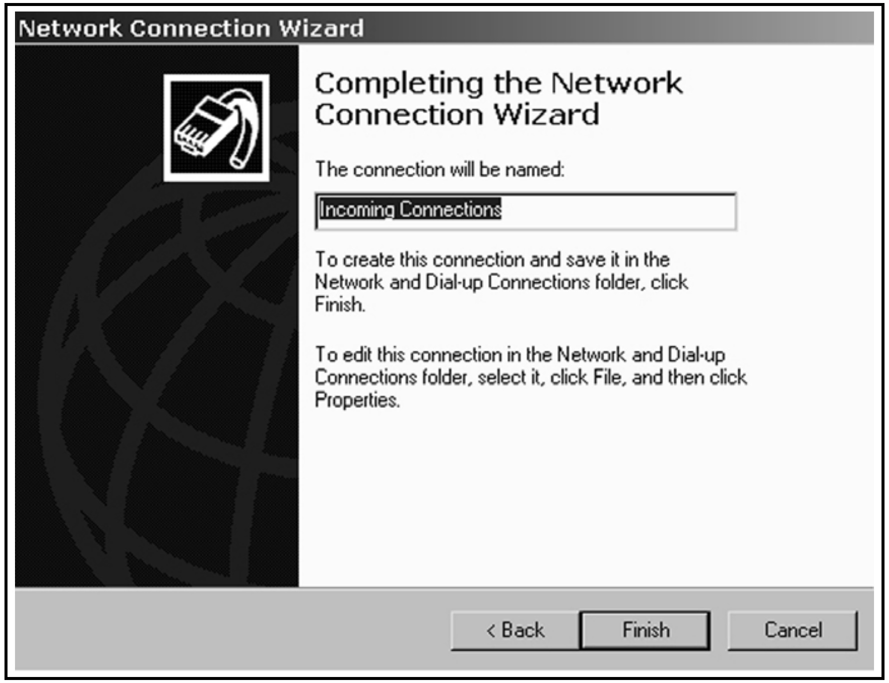
○ Assign TCP/IP addresses automatically using DHCP
● Specify TCP/IP addresses

From: 169 . 254 . 0 . 1
To: 169 . 254 . 0 . 2
Total: 2

☐ Allow calling computer to specify its own IP address

NOTICE You MUST use these IP addresses, they are not related to the System network IP address!!!

Fig. 350: Completing the Network Connection Wizard window



Network Connection Wizard

Completing the Network Connection Wizard

The connection will be named:

Incoming Connections

To create this connection and save it in the Network and Dial-up Connections folder, click Finish.

To edit this connection in the Network and Dial-up Connections folder, select it, click File, and then click Properties.

- The Completing the Network Connection Wizard window will complete the procedure for selecting and configuring the modem by adding Incoming Connections, i.e. the default connection name which shall not be changed. From the same window select Back to go back to the previous window or Cancel to exit from the Network Connection Wizard window. Select Finish to complete the procedure correctly. The remote external connection with the configured user (only serv) is now on

Generic Windows Printer

NOTICE	The printer must be compatible with WIN2000 Professional and have the correct drivers!!!

- Shut down the system
- Connect the printer cable to the System parallel port (PC unit rear side)
- Switch on the printer and the System then perform the log on as **Admin**
- Click on **Start→Settings→Printers**
- Double click on **Add Printer** to start the program **“Add Printer Wizard”**
- In the window **“Welcome to the Add Printer Wizard”** click on **Next**
- In the window **“Local or Network Printer”** select Local printer and click on **Next**
- In the window **“Select the Printer Port”** select **Use the following port**, then in the list select the port **LPT1** and click on **Next**
- In the window **“Add Printer Wizard”**
  - if the drivers are present in the operating system select printer manufacturer (**Manufacturer** column) and the model (**Printers** column) then click on **Next**
  - if the drivers are not present in the operating system click on **Have disk** and follow the procedure present in the Printer User Manual to install the drivers then click on **Next**
- In the window **“Name Your Printer”** check and write down the **Printer name** assigned by the System then click on **Next**
- In the window **“Printer Sharing”** select **Do not share this printer** and click on **Next**
- In the window **“Print Test Page”** select **Yes** and click on **Next**
- In the window **“Completing the Add Printer Wizard”** click on **Finish** then try to print the test page in order to verify the correct Printer installation
- Now set the printer as the default printer for the user ESAMRI:
  - Perform the log on as ESAMRI
  - Click on **Start→Settings→Printers**
  - Double click on the correct printer name
  - In the opened window select the menu **Printer** and the option **Set As Default Printer**
  - Close the window and verify that printer has now the default printer label (black dot with V sign in it)

NOTICE	OPI can use only one window printer set as default!!!

- Print from OPI selecting the **Windows Printer**

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Part 12 Disassembly & Disposal

Disassembly

Pavilion de-install

The procedure should be the same as for mounting but carried out in reversed order.

⚠**WARNING**	**The pavilion must be disassembled by trained people only**

⚠**WARNING**	**The pavilion must be disassembled from inside. Do not stand on the pavilion ceiling. This may cause mechanical failure of the structure.**

System de-install

The procedure should be the same as for mounting but carried out in reversed order.

⚠**WARNING**	**The System must be disassembled by trained people only**

Disposal of materials

NOTICE	To protect humans, animals, and the environment, recyclable and non-recyclable materials must be prepared for re-use or proper disposal

Recycling and disposal of materials apply when they are replaced during the useful life of the system, as well as when the MR System is scrapped.

Any parts of the unit and/or packaging that can be recycled are marked with the relevant symbol.

Furthermore all the parts that are used for packaging can be recycled or reused, except for the protection barrier.

The consumable parts of the equipment and the equipment itself at the end of their lifetime must be disposed of following the national and/or federal and/or local laws.

NOTICE	In our products, the amount of non-recyclable materials has been reduced to a minimum. In all countries, recycling and disposal procedures must adhere to country specific regulations.

Permanent magnet

In order to achieve an environmentally friendly and safe disposal, the magnet must be de-magnetized.

We recommend the following order:

- Disassembly of covers, electrical components, RF and gradient coils
- Transport
- Demagnetization
- Disposal

Disassembly of covers, electronic components, RF and gradient coils

⚠**WARNING** **The permanent magnet must be demagnetized before its components are disassembled**

- Install transport dedicated device
- The magnet opening must be protected in a way that no loose metal objects can fly through the opening accidentally
- Package magnets in suitable crate with dimensions 171 x 186 x 182 cm
- Attach warning signs on transport crates in required languages
  - – Strong magnetic field
  - – No pace-makers
  - – No metallic implants
  - – No loose metal objects

Demagnetization

We suggest the following procedure for demagnetizing:

- Remove packaging, foam, synthetic material, cables and assemblies
- A large oven is needed to demagnetize the permanent magnet. The following minimum inner dimensions of the oven must be met: width 1,000 mm, depth 1,000 mm and height 1,000 mm; care should be taken inserting the Magnet into the oven
- Heat the permanent magnet in the oven for 8 hours at 500 degrees Celsius
- After cooling, check whether the demagnetization has been completed successfully

Disassembly of the permanent magnet

- After demagnetization the magnet can be disassembled into its individual components. A 2 Tons crane is required for this

Disposal

All the ferromagnetic parts and the not magnetic parts of the Magnetic System can be recycled after cleaning. Magnetic parts can also be recycled after cleaning or disposed as industrial waste

Safety guidelines

MR System

NOTICE	The entire MR System and the on-site power distribution System must be switched off and secured against accidental switch-on for the duration of the activities listed in this register

MR phantom fluids

Fluids can leak out of an MR phantom when it is improperly used, damaged or being refilled with distilled water. For this reason, please follow the health and safety regulations described.

Basic regulations

⇨Eating, drinking, smoking, and intentional inhalation of vapors are not permitted when working with MR phantom fluids.

⇨Hands should be thoroughly washed with soap and water after working with MR phantom fluids.

⇨As added protection, wear a lab coat whenever working with MR phantom fluids.

Safety

For your own safety and the safety of third parties as well as the MR System and its components, adhere to the MR-specific safety information, which include:

- General safety requirements for service personnel
- Location of warning and prohibitive signs
- Precautions/restrictions, e.g. prohibiting ferromagnetic materials
- Handling heavy loads
- Operation of lasers
- Protective conductor measurements prior to System switch-on and after repairs
- Handling and disposal of leaking MR phantom containers
- Handling and storage of phantoms
- Procedure for handling spilled phantom fluids

Protective clothing

- Disposable gloves (of a waterproof material, such as latex, PVC, nitrile rubber, or polyethylene)
- Standard protective goggles

First Aid

If you come in contact with MR phantom fluids despite following the safety guidelines, adhere to the following first aid measures:

In the event of contact with skin

- Thoroughly wash the area affected with soap and water.
- The wastewater from washing should be put into a container. Label the container and dispose of it properly.
- If any clothing is contaminated, remove it and dispose of it properly.

In the event of contact with eyes

- Keep the eyelids open and flush out the eyes under running water for 10-15 minutes.
- Contact a physician immediately.

If vapors are inhaled

Move into fresh air and contact a physician immediately.

If swallowed

- Drink plenty of water and induce vomiting.
- Contact a physician immediately.

Batteries

Switch off the System before removing the battery inside the CPU board contained in the PC unit in the System console.

NOTICE	Remove the battery and give it to a disposal company

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